IN THE COURT OF COMMON PLEAS UNION COUNTY, OHIO

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CONSENT ORDER AND FINAL JUDGMENT

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APPENDICES

Appendix A:	Map of the Facility and the Site.
Appendix B:	Index of RCRA Corrective Action Guidance Documents.
Appendix C:	Approved RFI Workplan.
Appendix D:	Site-Specific Corrective Measures Implementation Scope of Work
Appendix E:	Pond 3 Closure.

I. INTRODUCTION

1. Plaintiff, the State of Ohio, by and through its counsel, Attorney General Betty D. Montgomery, and at the written request of the Director of Environmental Protection, filed a Complaint (hereinafter "Complaint") against The Scotts Company (hereinafter "Scotts" or "Defendant") pursuant to Ohio Revised Code ("Ohio R.C.") Chapters 3734 and 6111, and the regulations adopted thereunder.

2. WHEREAS, the State of Ohio's Complaint alleges that activities conducted at Defendant's facility located in Union County, including its wastewater treatment plants, former landfills, ponds, and broadcast areas have resulted in releases of pollution and contamination at the Site; and

3. WHEREAS, the State of Ohio's Complaint alleges that Defendant's operation of its former wastewater treatment plants resulted in violations of the discharge limitations and monitoring requirements of NPDES Permit No.4IF00000*HD; and various operations and activities carried out at Defendant's facility have resulted in pollution of waters of the state; and

4. WHEREAS, the State of Ohio's Complaint alleges that as a result of having held an interim hazardous waste facility permit, Defendant is required to take corrective action under Ohio R.C. Chapter 3734, Ohio R.C. Chapter 6111, and the Resource Conservation and Recovery Act, ("RCRA"), 42 U.S.C. 6921, et seq., to address past on-site releases of RCRA regulated-wastes. The Defendant is also required to take certain measures to prevent and abate prohibited discharges to waters of the State pursuant to R.C. Chapter 6111.

5. NOW THEREFORE, without trial or admission of any issue of fact or law, and upon the consent of the parties hereto, it is hereby ORDERED, ADJUDGED and DECREED as follows:

II. OBJECTIVES OF PARTIES AND PURPOSES OF CONSENT ORDER

6. In entering into this Consent Order, the principal objectives of Plaintiff and Defendant, are: [1] to institute required controls of the sources of releases or potential releases to sediment and waters of the State from the Immediate Units of Concern ("IUC"), and [2] to implement for the Site and IUCs, including Impacted portions of Crosses Run, such corrective actions and remedial measures as are necessary to protect human health, aquatic life, and the environment; and [3] to require the operation of the Facility to be in compliance with the applicable requirements of Chapters 3734 and 6111 of the Revised Code.

III. JURISDICTION AND VENUE

7. The Court has jurisdiction over the parties and the subject matter of this action pursuant to Ohio R.C. Chapters 3734 and 6111. The Complaint states a claim upon which relief can be granted against Defendant and venue is proper in this Court.

IV. DEFINITIONS

8. Unless otherwise stated, all terms used in this Consent Order shall have the same meaning as used in Ohio R.C. Chapters 3734 and/or 6111 and the regulations adopted thereunder. In addition, the following terms are defined as follows:

- A. "Additional Work" means any work in addition to the tasks defined in the approved workplans and other requirements of this Consent Order that Ohio EPA or Defendant may determine may be necessary to accomplish and maintain objectives one [1] and two
 [2] of Section II [Objectives of Parties and Purposes of Consent Order] of this Consent Order.
- B. "Additional Work Workplan" means those documents that are to be submitted to Ohio EPA by Defendant pursuant to Section IX.A.5 ("Additional Work") of this Consent Order. Each Workplan required to be submitted to Ohio EPA pursuant to Section IX.A.5 ("Additional Work") of this Consent Order shall include a detailed description of the proposed activities; a time schedule for conducting those activities; and any special or unusual personnel and equipment needs likely to affect the schedule or Work.

- C. **"Consent Order"** means this Consent Order and Final Judgment Entry and all appendices hereto. In the event of conflict between this Consent Order and any appendix, the Consent Order shall control.
- D. **"Constituents of Concern**" means those constituents identified pursuant to the approved RFI Workplan.
- E. **"Contractor"** means a contractor retained by or on behalf of Defendant pursuant to this Consent Order.
- F. "Defendant" or "Scotts" means The Scotts Company.
- G. "Director" means Ohio's Director of Environmental Protection and the Director's authorized representatives.
- H. "Facility," for purposes of this Consent Order, shall have the same meaning as Ohio R.C. 3734.01, and is confined to the main plant area and the waste treatment, storage and disposal areas, the waste water treatment and disposal areas, and shall include the portions of Defendant's property used for fertilizer, herbicide and pesticide formulation, all of which are situated on approximately 800 acres and located approximately 12 miles northwest of Columbus, Ohio on Scottslawn Road, Marysville, Ohio 43041 as indicated on the map attached as Appendix A.
- "Immediate Units of Concern" (IUCs) include the following units located at the Site: Landfills 1 through 5, and Field Broadcast

Areas 1 and 2, former Ponds 2, 3, 6, 7, and 8, including the ditch leading to former Pond 2 and Impacted portions of Crosses Run.

- J. "Impacted" means environmental media which shall be determined by a human health and ecological risk assessment .-analysis using approved methodologies to represent unacceptable risks, as referred to in the approved RFI Workplan.
- K. "NPDES Permit" means National Pollutant Discharge Elimination System permit issued in accordance with Ohio Adm. Code Chapter 3745-33.
- L. "OCAP" means "Ohio EPA Corrective Action Program Guidance".
- M. "Ohio EPA" means the Ohio Environmental Protection Agency.
- N. "Person" means any state or federal government including any political subdivision, department, agency, institution, or instrumentality thereof; an individual; corporation; business trust; estate; trust; partnership; association; municipal corporation; interstate body created by compact; and their officers, agents, employees, and/or any person acting in concert, privity or participation with any of them.
- O. "Plaintiff" means the State of Ohio by and through the Attorney General's Office.
- P. "PTI" means a permit to install issued in accordance with Ohio
 Adm. Code Chapter 3745-31.

- Q. "RCRA" means the Resource Conservation and Recovery Act, 42U.S.C. Section 6921, et seq.
- R. "Site" means the land upon which the Facility is located, the Impacted portions of Crosses Run, and any area that is being investigated by Scotts as part of the RFI Workplan, Appendix C to this Order. Additionally, Site includes those areas indicated on the map attached as Appendix A and areas where material(s) have migrated or threaten to migrate from those areas indicated on the map.
- S. "Waste Material" means (1) any "hazardous waste" as that term is defined in Ohio R.C. 3734.01 or Ohio Administrative Code ("OAC") 3745-50-10 or 3745-51-03; (2) any "hazardous constituent or constituents" as that term is defined in OAC 3745-51-10 and listed in the appendix to OAC 3745-51-11; (3) any "sewage" as that term is defined in Ohio R.C. 6111.01; (4) any "solid waste" as that term is defined in Ohio R.C. 3734.01; (5) any "industrial waste" as that term is defined in Ohio R.C. 6111.01; and (6) any "other waste" as that term is defined in Ohio R.C. 6111.01.
- T. **"Work"** means all activities Defendant is required to perform under this Consent Order.

V. CALCULATION OF TIME

9. In computing any period of time under this Consent Order, where the last day would fall on a Saturday, Sunday, or legal holiday, the period shall run until the end of the next day that is not a Saturday, Sunday or legal holiday.

VI. PERSONS BOUND

10. The provisions of this Consent Order shall apply to and be binding upon Defendant, its agents, officers, employees, assigns, successors in interest and any person acting in concert, privity or participation with it; provided, however, that Defendant's officers, directors, employees, agents or employees of any contractor or consultant engaged by Defendant to carry out Work to be performed pursuant to this Consent Order shall only be responsible to take action under this Consent Order in their corporate capacity and shall not be personally responsible for obligations assumed under this Consent Order.

11. Defendant shall provide a copy of this Consent Order to each key employee, consultant or Contractor employed to perform Work referenced herein.

VII. SATISFACTION OF LAWSUIT

12. Plaintiff alleges in its Complaint that Defendant operates and has operated its Facility and conducts and has conducted activities at the Site in such a manner as to result in numerous violations of the discharge limitations and monitoring requirements of its NPDES Permit No. 4IF00000*HD as well as unpermitted discharges and other activities in violation of Ohio's water pollution laws, Ohio R.C. Chapter 6111, and the regulations adopted thereunder, including but not limited to the Water Quality

Standards, OAC Chapter 3745-1, the Permit to Install regulations, OAC Chapter 3745-31 and the NPDES regulations, OAC Chapter 3745-33. Plaintiff further alleges that as a result of having held an interim hazardous waste facility permit, Defendant is also required to take corrective action under R.C. Chapter 3734, R.C. Chapter 6111, rules promulgated under those chapters and RCRA to address releases of Waste Materials from the IUCs to the Site. Defendant denies the allegations of Plaintiff's Complaint.

13. Except as expressly provided herein, compliance with the terms of this Consent Order shall constitute full satisfaction of any civil liability by Defendant for all claims alleged in the State's Complaint.

VIII. RESERVATION OF RIGHTS

14. Nothing in this Consent Order, including the imposition of stipulated civil penalties for violations of this Consent Order, shall limit the authority of the State of Ohio to:

- A. Seek any legal or equitable relief for claims or conditions not alleged in the Complaint, including violations that occur after the filing of the Complaint;
- B. Seek any legal or equitable relief for claims or conditions alleged in the Complaint which arise anew after the entry of this Consent Order.
- C. Seek any legal or equitable relief for claims or conditions alleged in the Complaint not addressed under this Consent Order.

- Enforce this Consent Order through a contempt action or otherwise seek relief pursuant to the terms of the Consent Order for violations of this Consent Order;
- E. Take any action authorized by law against any Person, including Defendant, to eliminate or mitigate conditions at the Facility, Site, or the surrounding areas that may present a threat to the public health or welfare, or the environment;
- F. Bring any action against Defendant or against any other Person, under the Comprehensive Environmental Response,
 Compensation and Liability Act (CERCLA), as amended, 42 U.S.C.
 § 9601, et seq. and/or R.C. 3734.20 through 3734.27 to:
 (1) recover natural resource damages, and/or (2) order the performance of, and/or recover costs for any removal, remedial or corrective activities not conducted pursuant to the terms of this Consent Order; and/or
- G. Bring any legal or equitable action against any Person other than Defendant.

15. By entering into this Consent Order, Defendant does not waive any rights, claims or defenses which it might have in any action identified in paragraph 14 of this Consent Order. Nothing in this Consent Order shall constitute or be construed as a waiver of any defense Defendant may have in any other claim, cause of action, or demand in law or equity brought by any other Person not subject to this Consent Order for any liability arising from, or related to, events or conditions at the Site or Facility.

Nothing in this Consent Order shall constitute or be construed as a waiver of any affirmative defense, claim, counterclaim, or cross-claim that Defendant may have in any claim, cause of action or demand in law or equity arising from alleged injury to the person or property of any agent, employee or contractor of Plaintiff arising from or received while in the course of performing their official duties relating to the implementation of this Consent Order.

IX. INJUNCTIVE RELIEF

IX.A. Corrective Actions

16. For purposes of conducting the Corrective Action pursuant to this Consent Order, Defendant is hereby enjoined and ordered as follows:

IX.A.1. RCRA Facility Investigation

17. On November 25, 1998, Defendant submitted a RCRA Facility Investigation ("RFI") Workplan for the IUCs and Crosses Run to Ohio EPA for approval. Subsequent responses to the Ohio EPA's comments and revisions to the RFI Workplan have also been submitted by Defendant. By letter dated March 24, 2000, Ohio EPA approved Defendant's RFI Workplan. The approved RFI Workplan is attached as Appendix C, which is incorporated by reference as if fully set forth herein.

18. Within 120 days after completing implementation of the approved RFI Workplan, Defendant shall submit to Ohio EPA a Final RFI Report in accordance with the guidance documents listed in Appendix B of this Consent Order and as outlined below:

- Purpose and Objectives: The Final RFI Report shall include a summary that identifies the purpose and objectives of the RFI and the Final RFI Report.
- 2) Data Presentation and Analysis: The Final RFI Report shall present the data gathered during the investigation. The report should also identify any gaps in the data. The methods used to gather, analyze, and summarize the data should also be described. The nature and extent of contamination discovered during the investigation shall be discussed in the report. Receptors or potential receptors of any contaminants detected shall be identified by using a conceptual site model or diagram. Evidence to support that the data meets the data quality objectives established in the RFI Workplan shall be included.
- 3) Evaluation of Data Against Cleanup Standards: In the absence of applicable generic cleanup standards, baseline risk assessments will be performed for human health and the environment. If Scotts utilizes site-specific risk assessments, all methodologies and assumptions used to perform them shall be identified. Any cleanup standards developed through these risk assessments shall also be identified.
- 4) <u>Summary Identify Potential Remedies/Future Course of Action:</u>

- The Final RFI Report Summary shall explore and describe one of the following options for each unit or media, including Crosses Run:
 - A presumptive remedy for one or more of the units or media.
 - Identifying the units or media for which a corrective measures study or limited corrective measures study is necessary.
 - 3. A finding of no further action for one or more of the units or media.
- b. Defendant shall evaluate the need for any necessary interim measures. All interim measures used on-site shall be evaluated for their effectiveness and what role the interim measures shall play in the overall corrective action.

19. If the results of an RFI show unacceptable human health or ecological risks to be present in Crosses Run, the Defendant is permanently enjoined and ordered to conduct additional investigations necessary to characterize the surface water and sediment, both upstream and downstream of the Scotts Facility for the Constituents of Concern. Defendant is permanently enjoined and ordered to take corrective measures to eliminate any unacceptable human health or ecological risks to be present in Crosses Run. Any sediment remediation or removal or management necessary to eliminate the unacceptable human health or ecological risk in those portions of Crosses Run included in the Site shall be done in conjunction and consistent with schedules

governing the RCRA corrective action, and shall, for constituents of concern, result in attainment of chemical water quality criteria in the water column.

IX.A.2 Corrective Measures Study

20. If an approved RFI Report, or an approved report summarizing the additional investigations conducted pursuant to paragraph 19 of this Consent Order, recommends that a Corrective Measures Study be conducted, the Corrective Measures Study shall be submitted within 180 days of the approval of either the RFI Report or the report summarizing additional investigations, whichever is approved later.

21. The corrective measures chosen for each unit or media, including Crosses Run, must meet both the threshold and balancing criteria for corrective measures found in Chapter 5 of the OCAP.

22. The corrective measures chosen for Crosses Run or for any unit or media affecting Crosses Run, must result, for Constituents of Concern, in attainment of the chemical water quality criteria in the water column.

IX.A.3 Corrective Measures Implementation

23. Within 30 days after receiving Ohio EPA's written approval of the Final RFI Report submitted February 16, 2001, additional investigations relating thereto conducted pursuant to paragraph 19 of this Consent Order, and any Corrective Measures Studies relating thereto, Defendant shall submit to Ohio EPA a schedule for conducting Corrective Measures Implementation ("CMI") for each IUC requiring action or additional investigation. The schedule shall include dates for the submission of

those items indicated in Section XI of Appendix D. The CMI shall be conducted in a manner consistent with the site-specific CMI Scope of Work contained in Appendix D to this Order, RCRA and its implementing regulations, R.C. Chapter 3734 and regulations promulgated thereunder, R.C. Chapter 6111 and the regulations promulgated thereunder, the OCAP and the other relevant guidance documents listed in Appendix B. All plans identified in Appendix D shall be subject to approval by Ohio EPA pursuant to the procedures set forth in Section XIII ("Review of Submittals"), unless otherwise indicated in Appendix D.

24. Within forty-five [45] days after receiving Ohio EPA's written approval of the schedule for conducting the CMI, Defendant shall begin implementation of the CMI as approved by Ohio EPA in accordance with the implementation schedules contained therein.

25. Within sixty [60] days after completing the CMI for an individual IUC, Defendant shall submit to Ohio EPA a construction completion report demonstrating that the CMI for that IUC was completed in a manner consistent with the site-specific CMI Scope of Work contained in Appendix D to this order, RCRA and the regulations promulgated thereunder, R.C. Chapter 3734 and regulations promulgated thereunder, R.C. Chapter 6111 and regulations promulgated thereunder, the OCAP, and the other relevant guidance documents listed in Appendix B.

26. Within sixty [60] days after completing implementation of the approved CMI for all IUCs, Defendant shall submit to Ohio EPA a Final CMI Completion Report. The Final CMI Completion Report shall describe the results of implementing the CMI, and shall be written in a manner consistent with the site-specific CMI Scope of Work

contained in Appendix D to this order, RCRA and the regulations promulgated thereunder, R.C. Chapter 3734 and regulations promulgated thereunder, R.C. Chapter 6111 and regulations promulgated thereunder, the OCAP, and the other relevant guidance documents listed in Appendix B.

IX.A.4. Notice of Threat and Interim Measures

27. If while in the course of implementing this Consent Order, Defendant identifies a condition that presents an immediate threat to human health or the environment that:

- A. arises from a source currently at the Site, whether or not identified at the time the consent order is entered; or
- B. emanates from the site now or in the future from a source currently at the Site, whether or not identified at the time the consent order is entered,

Defendant shall verbally notify Ohio EPA and begin implementing Interim Measures ("IM") to address the threat immediately. Defendant shall notify Ohio EPA in writing no later than five [5] days after identification of such conditions, summarizing the immediacy and magnitude of the threat and any actions Defendant has taken or will take to address the threat. The IM shall be consistent with all relevant guidance documents listed in Appendix B, and shall be integrated into any long term solution for corrective measures implemented at the Site unless such incorporation is determined by Ohio EPA to be incompatible with implementing a corrective measure. Within 30 days after implementing IM, Defendant is ordered and enjoined to submit to Ohio EPA

an IM Report that identifies interim measures performed by Defendant to mitigate the threat. Following receipt of Defendant's IM Report, if Ohio EPA determines that any Additional Work is necessary to address or mitigate the immediate threat, Ohio EPA will notify Defendant and the Additional Work shall be implemented in accordance with Ohio EPA's written direction and the IM Report modified accordingly following implementation.

28. If during the implementation of this Consent Order, Ohio EPA identifies a condition that presents an immediate threat to human health or the environment that:

- A. arises from a source currently at the Site, whether or not identified at the time the consent order is entered; or
- B. emanates from the site now or in the future from a source currently at the Site, whether or not identified at the time the consent order is entered,

and Ohio EPA notifies Defendant of the threat and the need for Defendant to respond to that immediate threat, Defendant shall implement IM to address the threat immediately. Defendant shall notify Ohio EPA in writing, no later than five [5] days after Ohio EPA notifies Defendant of the immediate threat, summarizing the immediacy and magnitude of the threat and any actions Defendant has taken or will take to address the threat. The IM measures shall be consistent with all the relevant guidance documents listed in Appendix B, and shall be integrated into any long term solution for corrective measures at the Site unless such incorporation is determined by Ohio EPA to be incompatible with implementing a corrective measure. Within thirty [30] days after implementing IM, Defendant shall submit to Ohio EPA an IM Report that identifies the

interim measures performed by Defendant to mitigate the immediate threat. Following receipt of Defendant's IM Report, if Ohio EPA determines that any Additional Work is necessary to address or mitigate the threat, Ohio EPA will notify Defendant and the Additional Work shall be implemented in accordance with Ohio EPA's written direction and the IM Report modified accordingly following implementation.

29. If Defendant claims that a condition at or emanating from the Site does not satisfy any of the criteria in Paragraphs 27.A and B and 28.A and B, Defendant shall have the burden of proving that claim in any action to enforce the terms of this Consent Order.

IX.A.5. Additional Work

30. This section applies to all of Section IX.A and IX.C.1 [Habitat Restoration]. Ohio EPA or Defendant may determine that in addition to the tasks defined in the approved workplans and other requirements of this Consent Order identified in Sections IX.A and Section IX.C.1 ("Habitat Restoration"), Additional Work may be necessary to accomplish and maintain compliance with objectives one [1] and two [2] of Section II [Objectives of Parties and Purposes of Consent Order] of this Consent Order. In the event that Ohio EPA determines that Additional Work is necessary to achieve and maintain compliance with those objectives of this Consent Order, Ohio EPA will orally notify Defendant and submit a written request to it explaining the need for and detailing the nature of the Additional Work. Within thirty [30] days of receipt of written notice from Ohio EPA that Additional Work is necessary, Defendant shall prepare and submit an Additional Work Workplan for Ohio EPA's review and approval for the performance

of the Additional Work in conformance with this Consent Order, RCRA and the regulations promulgated thereunder, R.C. Chapter 3734 and regulations promulgated thereunder, R.C. Chapter 6111 and regulations promulgated thereunder, the OCAP, and the other relevant guidance documents listed in Appendix B. Upon approval of the Additional Work Workplan by Ohio EPA pursuant to Section XIII (Review of Submittals), Defendant shall implement the Additional Work Workplan in accordance with the schedules contained therein.

31. In the event that Defendant determines that Additional Work is necessary to achieve and maintain the objectives of this Consent Order, Defendant shall submit a written request for approval, including a schedule for preparation of an Additional Work Workplan, to Ohio EPA explaining the need for and detailing the nature of the Additional Work prior to performing the Additional Work. Upon agreement by Ohio EPA of Defendant's request, Defendant shall develop an Additional Work Workplan in conformance with the approved schedule, this Consent Order, RCRA and the regulations promulgated thereunder, R.C. Chapter 3734 and regulations promulgated thereunder, the OCAP, and the other relevant guidance documents listed in Appendix B. Upon approval of the Additional Work Workplan by Ohio EPA pursuant to Section XIII ("Review of Submittals"), Defendant shall implement the Additional Work Workplan in accordance with the schedules contained therein.

32. In the event that Additional Work is necessary to accomplish any task described in any approved workplan, the deadline for completing such task(s) shall be

that deadline described in the schedule contained in the approved Additional Work Workplan.

33. Defendant may invoke the procedures set forth in Section XVI ("Dispute Resolution") to dispute any determination by the Ohio EPA that Additional Work is necessary to achieve and maintain the objectives of this Consent Order.

IX.A.6 Remediation on ODOT's Easement and Fee Property

34. Defendant shall take such steps as are necessary to link and integrate its remediation efforts on Landfill 3 to those conducted to date by the Ohio Department of Transportation on the Ohio Department of Transportation's easement and fee simple property on the Northeast side of State Route 33. This connection shall be made in a manner protective of human health and the environment and, to the extent not already planned or completed, Defendant shall submit plans, including schedules, to Ohio EPA for review and approval. Plans for work required by this section shall be submitted in concurrence with plans for work on other portions of Landfill 3. Work required by this section shall be performed in concurrence with work on other portions of Landfill 3.

IX.B. Recycle 1 System Compliance

35. The Defendant is hereby enjoined and ordered to comply with all applicable requirements for the Recycle I system.

IX.C. Surface Water Compliance

36. For purposes of conducting Surface Water Compliance work pursuant to this Consent Order Defendant is hereby enjoined and immediately ordered as follows:

37. Except as otherwise provided in this Consent Order, Defendant is permanently enjoined and ordered to immediately comply with the applicable provisions in Ohio's water pollution control laws, Ohio R.C. Chapter 6111, the regulations adopted thereunder, including but not limited to, the Permit to Install regulations contained in OAC Chapter 3745-31, the terms and conditions of its expired NPDES Permit No.4IF00000*HD until such time as a renewal permit is issued, and the terms and conditions of any renewals or the modifications of any subsequent NPDES permits.

IX.C.1 Habitat Restoration

38. In conjunction with submission of the schedule for conducting the CMI, Defendant shall submit a plan for implementation of habitat restoration in Crosses Run ("Habitat Restoration Plan"). The plan shall include a schedule of implementation and be subject to review and approval by Ohio EPA. Defendant shall implement the Habitat Restoration Plan consistent with the schedule as approved.

By letter dated July 28, 2000, and pursuant to Ohio Adm. Code 3745-27 Defendant applied for permission to remove sediment from approximately four
 hundred feet of Crosses Run adjacent to Landfill 3 and to place the sediment on Landfill
 On August 11, 2000, Ohio EPA authorized that application with conditions. To the
 extent not already completed, Defendant shall conduct that activity in accordance with
 the July 28, 2000 letter and the conditions of Ohio EPA's approval thereof. That activity

shall be carried out in conformance with this Consent Order, the approved RFI Workplan, RCRA and the regulations promulgated thereunder, R.C. Chapter 3734 and regulations promulgated thereunder, R.C. Chapter 6111 and regulations promulgated thereunder, the OCAP, all other workplans, the other relevant guidance documents listed in Appendices B and D and in a manner that assures that Section IX.C.1 ("Habitat Restoration") can be fully and effectively implemented to satisfy the objectives of this Consent Order.

IX.C.2. Wastewater Treatment Plants

40. Defendant has ceased, and is permanently enjoined from, operating its Wastewater Treatment Plants operating under NPDES Permit No. 4IF00000*HD ("WWTPs") and the wastewater treatment units for the Recycle I System (outfall 010) in such a manner as to discharge any sewage, industrial waste or other wastes directly to waters of the state or into any other recycle systems at the Facility unless properly permitted.

41. Defendant has eliminated outfalls 001, 002, 003, 004, and 005, as identified in Defendant's NPDES Permit No. 4IF00000*HD, by connecting to the City of Marysville sanitary sewer system. Defendant currently is not authorized to discharge any waste materials associated with the Recycle I System to the City of Marysville sewer system.

42. Defendant is permanently enjoined to properly operate and maintain any wastewater treatment or pretreatment equipment necessary so that any discharges from the Facility to the City of Marysville sanitary sewer system are in compliance with

the City of Marysville pretreatment program and Ohio law. Defendant is permanently enjoined to operate in compliance with the City of Marysville pretreatment program and Ohio law. Any change in the method of disposal of the waste materials from the Recycle I system occurring after the date of entry of this Consent Order shall only occur in full compliance with applicable state and federal law.

IX.C.3 Stormwater Pollution Prevention Plan

43. Defendant has filed an application for an individual stormwater NPDES permit with Ohio EPA.

44. Within six months of the entry of this Consent Order, Defendant shall submit to Ohio EPA for review and comment a comprehensive plan for the implementation of best management practices for the control of storm water runoff ("Stormwater Pollution Prevention Plan" or "SWPPP"). The SWPPP shall include provisions for the comprehensive monitoring of surface water quality in order to demonstrate the efficacy of the management practices and controls contained in the SWPPP. This comprehensive monitoring shall provide for both identification of sources and quantification of wet weather loadings of ammonia, phosphorus, pesticides, and herbicides in terms of constituents discharged via stormwater runoff to Crosses Run from: (a) all property on which Defendant, or its predecessors or successors in interest, conduct or conducted any industrial activity and the research laboratory buildings; and (b) all property where Defendant or its predecessors or successors in interest have created a point source by altering the natural flow patterns of stormwater sheet flow through grading or other activities. Potential loading sources to be addressed by Best

Management Practices shall include, but not be limited to storage and containment areas, loading and unloading practices, nutrient pond management practices, former field broadcast areas, and former solid waste management units. In the event the SWPPP is submitted before the NPDES Stormwater permit is issued, the SWPPP shall be subject to Section XVI ("Dispute Resolution"). After the NPDES Stormwater permit is issued, the SWPPP shall no longer be subject to Dispute Resolution. If Ohio EPA issues its acceptance of the SWPPP, Defendant shall within ninety (90) days implement the Stormwater Pollution Prevention Plan. The Defendant shall have an ongoing obligation to maintain and implement a SWPPP, however the amendment or alteration of the SWPPP after Ohio EPA's acceptance thereof shall not be subject to this Consent Order.

IX.C.4 <u>Containment - Water Stop Devices</u>

45. Defendant is enjoined and ordered to render the in-stream spill containment devices, also known as the "water stops", installed on Crosses Run inoperable by removing the gates from the containment devices in accordance with a schedule to be included, reviewed and implemented with the SWPPP. Defendant shall amend its Spill Prevention and Counter-Measure Control Plan to account for changes in spill control occurring as a result of the implementation of this Consent Order.

IX.C.5 Above Ground Storage Tanks 5 and 5A

46. On November 13, 1998, Ohio EPA issued PTI Application No. 01-7821 to Scotts for the closure of the Above Ground Storage Tanks (AST) 5, and 5A. Scotts has

supplied documentation to Ohio EPA indicating that it has gone forward with closure. Defendant is ordered and enjoined to complete the closure of AST 5 and 5A in accordance with PTI Application No. 01-7821 within 60 days of the entry of this consent order.

IX.C.6. POND 3

47. On October 22, 1999, Defendant submitted to Ohio EPA's Central District Office an application for a PTI for Closure of Pond 3 that included the disposal of Pond 3 wastewaters generated from the vermiculite expansion process (also known as Recycle 4 waste stream) and the solidification in place and capping of the solids that have accumulated in Pond 3 during its operation. Subsequently Defendant has submitted additional data characterizing the constituents present in the vermiculite solids and other solids in Pond 3 and further data related to groundwater. Defendant has submitted a PTI application for Closure of Pond 3. This application is required to provide for closure of Pond 3 that at a minimum is consistent with the performance standards set forth in Appendix E to this Consent Order. This application is required to include: a) land application of the wastewater in the Pond in accordance with an approved nutrient management program; b) relocation of the vermiculite solids located in close proximity to Crosses Run in order to facilitate the creation of a 10 ft wide barrier wall between the solids and the stream bank; c) construction of the cap and barrier wall using soils that meet particle size distribution and permeability requirements contained in Appendix E; d) the cap shall be at least 2 feet thick with a minimum slope of 4%; e) testing verification and proper monitoring before, during, and upon completion of the

construction to insure specifications are met; establishment of a dense vegetative cover; post closure care adequate to maintain the cap and monitor the groundwater in the vicinity. If the application fails to satisfy the requirements set forth in this paragraph or Appendix E, Ohio EPA may require Defendant to submit a new or amended PTI application. If Ohio EPA requires Defendant to submit a new or amended PTI application, Defendant shall submit such PTI application within forty five (45) days of the date upon which Ohio EPA issues its request. Defendant shall complete closure on Pond 3 in accordance with the PTI as approved no later than December 1, 2001.

48. Defendant shall maintain two feet of freeboard at all times in Pond 3 until September 30, 2001. Thereafter Defendant shall maintain three feet of freeboard in Pond 3 at all times until this unit is closed.

IX.D. SAMPLING AND DATA AVAILABILITY

49. Defendant is ordered and enjoined to notify Plaintiff not less than five [5] working days in advance of all sample collection activity related to this Consent Order, unless associated with testing for an occurrence Scotts believes is potentially associated with an immediate threat to human health or the environment, at which time Scotts will immediately notify Ohio EPA of such testing. Upon Ohio EPA's request, Defendant shall allow split and/or duplicate samples to be taken by Ohio EPA. Defendant shall allow Ohio EPA to take any and all additional samples Ohio EPA deems necessary for its oversight of Defendant's implementation of the Work required by this Order. Defendant may take split and/or duplicate samples of any samples Ohio

50. Within ten [10] working days after receipt of sampling data, Defendant shall submit to Ohio EPA copies of the results of any and all sampling and/or tests or other data, including but not limited to raw data and original laboratory reports, generated by or on behalf of Defendant with respect to the implementation of this Consent Order. When or if Defendant or its consultants prepare a report concerning the quality or accuracy of the raw data and/or laboratory reports, Defendant shall also submit to Ohio EPA any such report. Should Defendant discover an error in any such report or raw data, Defendant shall notify-Ohio EPA of such discovery and provide the correct information upon submission of the report or data or within twenty [20] working days of discovery, which ever is earlier.

X. <u>ACCESS</u>

51. Defendant is ordered and enjoined to allow Ohio EPA access at all reasonable times to the Facility and the Site to which access is required for the implementation of this Consent Order, to the extent access to the Site is controlled by Defendant. Access under this Consent Order shall be for the purposes of conducting any activity related to this Consent Order.

52. To the extent that the Site or any other property to which access is required for the implementation of this Consent Order is owned or controlled by persons other than Defendant, Defendant shall use its best efforts to secure from such persons access for Defendant and Plaintiff and/or Ohio EPA as necessary to effectuate this Consent Order. For the purposes of this Paragraph, best efforts with respect to Plaintiff or Ohio EPA shall be limited to inclusion of Ohio EPA in Defendant's proposed access

agreement and reasonable follow-up, including addressing questions or concerns with respect to the proposed access agreement, denials or failure to respond. In no case shall Defendant be required to incur any additional monetary obligations in order to secure access for Ohio EPA. Copies of all access agreements obtained by Defendant shall be provided promptly to Ohio EPA. If any access required to effectuate this Consent Order is not obtained within thirty [30] days after the entry of this Consent Order, or within thirty [30] days after the date Ohio EPA notifies Defendant in writing that additional access beyond that previously secured is necessary, Defendant shall promptly notify Ohio EPA in writing of the steps Defendant has taken to attempt to obtain access. Plaintiff may, as it deems appropriate, assist Defendant in obtaining access. Failure by Defendant to gain access despite best efforts, and any delay resulting therefrom, will not be considered a violation of this Consent Order.

53. Notwithstanding any provision of this Consent Order, the State of Ohio retains all of its access and inspection rights and authorities, including enforcement authorities related thereto, under any applicable statute or regulations.

XI. PROGRESS REPORTS AND NOTICE

54. Unless otherwise directed by Ohio EPA, Defendant shall submit a written progress report to Ohio EPA by the twentieth day of every other month following the entry of this Consent Order. At a minimum, the progress reports shall identify the Site and/or Facility and activity and:

A. Describe the status of the Work during the reporting period;

- B. Describe difficulties encountered during the reporting period and actions taken to address any difficulties;
- C. Describe activities planned for the next two months;
- D. Identify changes in key personnel;
- E. List target and actual completion dates for each element of activity, including project completion;
- F. Provide an explanation for any deviation from any applicable schedules; and
- G. For the reporting period, indicate the volume of contaminated soil removed, the volume of contaminated sediment removed, and how much contaminated ground water was pumped and where such contaminated media were disposed of.

Beginning 36 months after the entry of this consent order, Defendant may request an alternative reporting frequency from Ohio EPA and such alternative reporting frequencies shall be used upon the concurrence of Ohio EPA. Any request for an alternative reporting frequency shall be delivered to all Ohio EPA personnel referenced in Section XII [Submittal of Documents and Notices]. In addition, Ohio EPA may at any time require such alternative reporting frequencies as it deems appropriate.

XII. SUBMITTAL OF DOCUMENTS AND NOTICES

55. Documents and written notifications that are required to be submitted to Plaintiff or Ohio EPA pursuant to this Consent Order shall be sent by certified mail

return receipt requested, or equivalent, to the appropriate Ohio EPA office at the

addresses listed below:

Ohio EPA, Central District Office Attn: DSW Enforcement Group Leader 3232 Alum Creek Drive Columbus, Ohio 43207

Ohio EPA, Central District Office Attn: RCRA Group Leader 3232 Alum Creek Drive Columbus, Ohio 43207

Ohio EPA Lazarus Government Center Division of Hazardous Waste Management Attn: Manager, Compliance Assurance Section P.O. Box 1049 Columbus, Ohio 43216-1049

Ohio EPA Lazarus Government Center Division of Surface Water Attn: Enforcement Coordinator P.O. Box 1049 Columbus, Ohio 43216-1049

Documents and written notifications that are to be submitted to Defendant shall be

sent by certified mail return receipt requested, or equivalent to:

Gary Daugherty Director, Corporate Environmental Engineering The Scotts Company 41 S. High Street Suite 3500 Columbus, Ohio 43215

Richard P. Fahey Kristin L. Watt Vorys, Sater, Seymour and Pease LLP 52 East Gay Street P.O. Box 1008

Columbus, Ohio 43216-1008

56. Oral Notices required to be given to the Plaintiff by this Consent Order shall be given by notifying the RCRA Group Leader in Ohio EPA's Central District Office and/or DSW Enforcement Group Leader in Ohio EPA's Central District Office,

57. Either party may change the name and/or address of its contact person(s) by sending written notice of the relevant change(s) to the other party.

XIII. REVIEW OF SUBMITTALS

58. Every document required to be submitted to Ohio EPA under this Consent Order is subject to the review and approval of Ohio EPA in accordance with this Consent Order and applicable State and federal laws. In addition, all documents submitted pursuant to Sections IX.A. ("Corrective Action") and IX.C.1 ("Habitat Restoration") are also subject to review and approval in accordance with the guidance documents listed in Appendix B. Upon Ohio EPA's review of any workplan, report, or other item required to be submitted pursuant to this Consent Order, Ohio EPA may in its sole discretion: (a) approve the submission in whole or in part; (b) approve the submission upon specified conditions; (c) disapprove the submission in whole or in part; (d) notify Defendant of deficiencies; or (e) any combination of the above.

59. If Ohio EPA disapproves a submission in whole or in part, Ohio EPA will notify Defendant of the deficiencies in writing. Defendant shall within thirty [30] working days of receipt of Ohio EPA's written notice, or if supplemental field, laboratory, or other investigatory work is performed, within thirty [30] working days of completion of such

work, or such longer period of time as specified in writing, correct the deficiencies and resubmit to Ohio EPA for approval a revised submission. The revised submission shall incorporate the uncontested changes, additions, and/or deletions specified by Ohio EPA in its notice of deficiency. Notwithstanding the notice of deficiency, Defendant shall proceed to take any action(s) required by the approved portion(s) of the submission.

60. If Ohio EPA does not approve a revised submission, in whole or in part, Ohio EPA may again require Defendant to correct the deficiencies and incorporate all changes, additions, and/or deletions within fourteen [14] days, or such time period as specified by Ohio EPA in writing. In the alternative, Ohio EPA may modify or disapprove the revised submission. Defendant retains the right to assert through dispute resolution in accordance with Section XVI ("Dispute Resolution") that the revised submission was not deficient.

61. In the event of approval by the Ohio EPA of any submission, Defendant shall proceed to take any action required by the submission. In the event of approval upon condition, or modification by the Ohio EPA of any submission, Defendant may either proceed to take any action required by the submission as conditionally approved or modified by Ohio EPA, or invoke dispute resolution in accordance with Section XVI ("Dispute Resolution").

XIV. ACCESS TO INFORMATION

62. Except as provided in Paragraph 64, Defendant shall provide to Plaintiff or Ohio EPA, upon request, copies of all documents and information within its possession,

control or ability to control, including those of its contractors or agents, relating to events or conditions at the Facility or Site which are pertinent to this Order including, but not limited to manifests, reports, correspondence, or other documents or information related to the work required under this Consent Order.

63. Defendant may assert a claim that documents or other information submitted to Plaintiff or Ohio EPA pursuant to this Consent Order are confidential under the provisions of OAC 3745-50-30(A) or Section 6111.05. If no such claim of confidentiality accompanies the documents or other information when it is submitted to Plaintiff or Ohio EPA, it may be made available to the public without notice to Defendant. Plaintiff reserves the right to dispute the claim of confidentiality and respond to any request for an *in camera* review prior to the decision by the court regarding the existence of the privilege.

64. Defendant may assert that certain documents or other information are privileged under the attorney-client or any other privilege recognized by state law or applicable federal law. If Defendant makes such an assertion, it shall provide Plaintiff with the following:

- A. the title of the document or information;
- B. the date of the document or information;
- C. the name and title of the author of the document or information;
- D. the name and title of each addressee and recipient;
- E. a general description of the contents of the document or information; and

F. the privilege being asserted by Defendant.

To the extent that Defendant asserts that providing any of the information set forth in this paragraph would itself disclose privileged information, Defendant shall submit such information to the Court to enable the Court to conduct an *in camera* review and rule on the validity of Defendant's claim of privilege. If Defendant provides information to the Court pursuant to the preceding sentence, Defendant shall indicate to Plaintiff the categories (A through F, supra) to which the information pertains and will provide to Plaintiff all documents and portions thereof for which no claim of privilege has been made. Plaintiff reserves the right to dispute the claim of privilege and respond to any request for an *in camera* review prior to the decision by the court regarding the existence of the privilege.

65. No claim of confidentiality shall be made with respect to any data, including but not limited to, all sampling, analytical monitoring, or laboratory or reports concerning the quality or accuracy of the raw data and/or laboratory reports.

66. Defendant shall preserve for the duration of the performance of Work pursuant to this Consent Order and for a minimum of five [5] years after Plaintiff's acceptance of Defendant's certification of completion and compliance with this Consent Order, all documents and other information within its possession, control or ability to control, including those of its contractors or agents, which in any way relate to the Work performed pursuant to this Consent Order notwithstanding any document retention policy to the contrary. Defendant may preserve such documents by microfiche, or other electronic or photographic device. At the conclusion of this document retention period, Defendant shall notify Plaintiff at least sixty [60] days prior to the destruction of these

documents or other information; and upon request, shall deliver such documents and other information to Plaintiff.

XV. INDEMNITY

67. Defendant agrees to indemnify, save, and hold harmless the State of Ohio from any and all claims or causes of action arising from, or on account of, the State of Ohio's oversight activities pursuant to this Consent Order during the duration of this Consent Order and/or acts or omissions of Defendant, their officers, employees, receivers, trustees, agents, or assigns, in carrying out any oversight activities pursuant to this Consent Order. The State of Ohio agrees to provide notice to Defendant within Ninety [90] days of receipt of any claim which may be the subject of indemnity as provided in this Section. During such 90 day period the State shall take all necessary action to defend the claims and preserve any defenses, including filing any required pleadings. The State of Ohio's failure to comply with the requirements of this Section shall constitute a waiver of the State's claim for indemnification if, and only if, Defendant is prejudiced by that failure to comply. The Parties shall cooperate with each other in the defense of any such claim or action against the State. The State of Ohio shall not be considered a party to and shall not be held liable under any contract entered into by Defendant in carrying out the activities pursuant to this Consent Order.

XVI. DISPUTE RESOLUTION

68. The provisions of the Dispute Resolution Section shall only be applicable to the following portions of this Consent Order: Section IX.A ("Corrective Actions"), Section IX.C.1(Habitat Restoration), Section IX.C.3 (Stormwater Pollution Prevention

Plan) and Section IX.C.6 (Pond 3). Additionally, the provisions of the Dispute Resolution Section shall be applicable to Section XII ("Review of Submittals") if the submittal relates to Section IX.A ("Corrective Actions"), Section IX.C.1 ("Habitat Restoration"), Section IX.C.2 ("Stormwater Pollution Prevention Plan") and Section IX.C.6 (Pond 3). This Dispute Resolution Section shall also be applicable to Section XIX ("Stipulated Penalties"), but only to the extent that the Defendant has a dispute regarding the factual issue of whether an approved deadline contained in the schedule of any Ohio EPA approved schedule was not met. The amount of any stipulated penalty owed for each day of violation is not subject to dispute resolution under this Section.

69. The parties shall, whenever possible, operate by consensus. In the event that a disagreement exists about the adequacy or disapproval of any Additional Work Workplan, deliverable or any report, or disagreement about the conduct of the Work performed under Section IX.A of this Consent Order, Ohio EPA and Defendant shall have ten [10] working days from the date dispute arises to negotiate in good faith an attempt to resolve the differences. The dispute arises when either Ohio EPA provides a brief written notice of dispute to Defendant, or vice-versa. This ten working day period may be extended by mutual agreement of the parties.

70. In the event Ohio EPA and Defendant are unable to reach consensus on the dispute, then Ohio EPA and Defendant shall reduce their positions to writing within fifteen [15] working days of the end of the good faith negotiations referenced in the preceding paragraph. Those written positions shall be immediately exchanged by Ohio EPA and Defendant. Following the exchange of written positions, the parties shall have
an additional fifteen [15] working days to resolve their dispute. If Ohio EPA concurs with the position of Defendant, then the Workplan, report or other deliverable shall be modified consistent with Defendant's position as agreed to by Ohio EPA.

71. If Ohio EPA does not concur with the position of Defendant, Ohio EPA shall notify Defendant in writing. Upon receipt of such written notice, Defendant shall have seven days to forward a request for resolution of the dispute, along with a written statement of the dispute, to the appropriate Section Manager of either Ohio EPA's Division of Hazardous Waste Management or Division of Surface Water. The statement of dispute shall be limited to a concise presentation of Defendant's position on the dispute. The Ohio EPA, within seven days of receiving notice of the request for resolution of the dispute, may submit a written statement of the dispute. The Section Manager, or his/her designee will resolve the dispute based upon and consistent with this Consent Order, and State law including R.C. Chapters 3734 and 6111, and the regulations promulgated thereunder, and other appropriate state and federal laws, and issue his/her written decision stating Ohio EPA's formal position as soon as practicable but in no event later than within thirty [30] days of Defendant's request for dispute resolution under this paragraph. This is intended as an informal process, and the section manager may request additional information from either party to the extent he/she believes such information may aid in understanding and resolving issues in the dispute.

72. The pendency of dispute resolution set forth in this Section shall not affect the time period for completion of Work, unless otherwise provided, except that upon

written mutual agreement of the parties, any time may be extended as appropriate under the circumstances.

73. If Defendant does not agree with the Section Manager's resolution of the dispute either party may within fourteen [14] days of receipt of notice of the Section Manager's resolution petition this Court. In a court proceeding, Defendant shall have the burden of demonstrating by a preponderance of the evidence that the decision by Plaintiff is unlawful and unreasonable under applicable law or is inconsistent with this Order.

74. If either Defendant or Plaintiff believes that the dispute is not a good faith dispute, or that a delay would pose or increase a threat of harm to the public or the environment, either party may petition the Court for relief without following the dispute resolution procedures of this Section.

75. Within thirty [30] days of resolution of any dispute, Defendant shall incorporate the resolution and final determination in the RFI Workplan, Additional Workplan(s), or other deliverable schedule or procedures and proceed to implement this Consent Order accordingly.

76. Unless expressly provided for in this Consent Order, the dispute resolution procedures of this Section shall be the exclusive mechanism to resolve disputes arising under paragraph 68 of this Consent Order, which is the first paragraph of this section. However, the procedures set forth in this Section shall not apply to actions by the State of Ohio to enforce obligations of Defendant that have not been disputed in accordance with this Section.

XVII. LAND USE NOTICE AND CONVEYANCE OF TITLE

77. Within thirty [30] days after the entry of this Consent Order, Defendant shall record a notice with the County Recorder's Office for Union County, Ohio on the deed(s) to all property which is part of the Site and owned by Defendant. The notice shall reference the existence of this Consent Order and shall describe any disposal areas, storage areas and monitoring or containment devices relating to the IUCs or the Recycle 1 system currently present on Defendant's property and any disposal areas, storage areas and monitoring or containment devices relating to the IUCs or the Recycle 1 system which Defendant plans to install in the future. Defendant shall update the notice as needed to maintain accuracy.

78. Defendant shall assure that no portion of the Site will be used in any manner which would adversely affect the integrity of any containment or monitoring systems at the Site; provided, however, that a planned activity conducted on the Site which could adversely affect the integrity of any such systems implemented pursuant to the Order may be conducted if Defendant gives Ohio EPA at least thirty [30] days prior notice and implements protective measures or protective alternatives, including those required in writing by Ohio EPA . Defendant shall notify Ohio EPA and the Attorney General's Office, Environmental Enforcement Section by registered mail at least [30] days in advance of any conveyance of any interest in real property owned by Defendant which is known to comprise the Facility. Defendant's notice shall include the name and address of the grantee and a description of the provisions made for continued maintenance of containment and monitoring systems. In no event shall the conveyance of any interest in the property that includes, or is a portion of, the Site release or-

otherwise affect the liability of Defendant to comply with its obligations under this Consent Order.

XVIII. <u>CIVIL PENALTY</u>

79. Defendant is ordered and enjoined to pay to the State of Ohio a total civil penalty in the amount of Two Hundred Seventy Five Thousand Dollars (\$275,000.00). This amount shall be paid by delivering to Plaintiff, c/o Jena Suhadolni**¢**k, or her successor at the Office of the Attorney General of Ohio, Environmental Enforcement Section, 30 East Broad Street, 25th Floor, Columbus, Ohio 43215-3428, two cashier's or certified checks, one in the amount of Two hundred Sixty Five Thousand Dollars (\$265,000) and the other in the amount of Ten Thousand Dollars (\$10,000), payable to the order of "Treasurer, State of Ohio" within thirty (30) days from the effective date of this Consent Order.

XIX. STIPULATED PENALTIES

80. The following items shall be deemed critical path milestones:

- A. All requirements established in Section IX.A [Corrective Action], including Sections IX.A.1-6;
- B. All requirements established in Section IX.C [Surface Water Compliance], including Sections IX.C.1-6;

In addition, Defendant shall propose critical path milestones within all plans required to be submitted pursuant to Section IX.A [Corrective Action] and IX.C.1 [Habitat Restoration] of this Consent Order. The proposed critical path milestones shall be subject to review and revision by Ohio EPA pursuant to Section XIII [Review of "

Submittals] and subject to Section XVI [Dispute Resolution] to the same extent as the document in which the proposed critical path milestone is contained.

- A. For each day of each failure to comply with a requirement or meet a deadline up to and including 15 days —Two Hundred Fifty
 Dollars (\$250.00) per day for each requirement or deadline not met.
- B. For each day of each failure to comply with a requirement or meet a deadline from 16 to 30 days -- Five Hundred Dollars (\$500.00) per day for each requirement or deadline not met.
- C. For each day of each failure to comply with a requirement or meet a deadline from 31 to 60 days — Seven Hundred Fifty Dollars (\$750.00) per day for each requirement or deadline not met.
- C. For each day of each failure to comply with a requirement or meet a deadline after 60 days -- One Thousand Dollars (\$1,000.00) per day for each requirement or deadline not met.

82. In the event that Defendant fails to satisfy any requirement imposed only by paragraph 37 of this Consent Order, Defendant is liable for and shall pay stipulated penalties in accordance with the following schedule for each failure to comply:

A. For each day of each failure to comply with a requirement or meet
 a deadline up to and including 15 days —One Hundred Fifty^{*}

Dollars (\$150.00) per day for each effluent limitation, permit term or condition, requirement or deadline not met.

- B. For each day of each failure to comply with a requirement or meet a deadline from 16 to 30 days -- Three Hundred Dollars (\$300.00)
 per day for each effluent limitation, permit term or condition, requirement or deadline not met.
- C. For each day of each failure to comply with a requirement or meet a deadline after 30 days – Five Hundred Dollars (\$500.00) per day for each effluent limitation, permit term or condition, requirement or deadline not met.

83. Payments required by this section shall be paid within thirty [30] days after the violation by delivering a certified check payable to "Treasurer, State of Ohio," to Administrative Assistant, Environmental Enforcement Section, Ohio Attorney General's Office, 30 East Broad Street, 25th Floor, Columbus, Ohio 43215-3428, along with a letter summarizing the violations and dates for which the penalty is paid.

XX. TERMINATION OF STIPULATED PENALTIES

84. The provisions of this Consent Order set forth in Paragraph 82 requiring the payment of stipulated penalties for violations of requirements imposed only by Paragraph 37 of this Consent Order may be terminated upon a demonstration by Defendant that: 1) it has maintained substantial compliance with Section IX.C of this Consent Order for a period of thirty-six consecutive months, as determined solely by Plaintiff in its prosecutorial discretion; 2) it has completed the requirements outlined in Sections IX.C.2-5; and 3) it has paid all penalties required by this Consent Order.

85. If during the three (3) year period (thirty-six consecutive months) set forth in Paragraph 84, Defendant fails to meet the condition required in Paragraph 84(1), the three (3) year period (thirty-six consecutive months) will begin anew on the first date after such failure that the Defendant is back into substantial compliance with the terms and conditions in Section IX.C of this Consent Order, as determined solely by Plaintiff in its prosecutorial discretion. Any of Defendant's subsequent failures to maintain compliance with the terms and conditions in Section IX.C of of this Consent Order, shall be treated in the same manner, with the three (3) year period (thirty-six consecutive months) beginning anew from the date Defendant comes back into substantial compliance, as determined solely by Plaintiff in its prosecutorial discretion.

86. Termination of the stipulated penalty provisions of Paragraph 82 of this Consent Order shall be only by order of the Court upon application by any party, and a demonstration that the conditions outlined in Paragraph 84 have been met.

XXI. MISCELLANEOUS

87. Nothing in this Consent Order shall affect Defendant's obligation to comply with all applicable federal, state or local laws, regulations, rules or ordinances. Defendant shall obtain any and all federal, state, or local permits necessary to comply with this Consent Order. The parties acknowledge and agree that the issuance, renewal, modification, denial or revocation of permit(s) and the issuance of other orders or actions of the director of Ohio EPA are not subject to challenge or dispute before this Court but, rather, shall be subject to challenge under R.C. Chapters 119 and/or 3745.

88. Any acceptance by the State of Ohio of any payment, document or other Work due hereunder subsequent to the time that the obligation is due under this Consent Order shall not relieve Defendant from the obligation created by the Consent Order.

89. Nothing in this Consent Order shall constitute or be construed as a release from any claim, cause of action, or demand in law or equity against any Person not subject to the Consent Order for any liability arising from, or related to event or conditions at the Site or Facility.

90. Defendant shall inform Plaintiff of any change of its business name, addresses or telephone numbers, or the cessation of business.

XXII. COSTS

91. Defendant shall pay the court costs of this action.

XXIII. MODIFICATION AND TERMINATION OF THIS CONSENT ORDER

92. No modification shall be made to this Consent Order without the written agreement of the Parties and the Court.

93. Defendant may seek to terminate this Consent Order, with the exception of the document retention obligations set forth in Section XIV (Access to Information), at any time after completion of all Work required to be performed pursuant to this Consent Order. Defendant may seek such termination only by filing a motion with this Court pursuant to Rule 60(B)(4) of the Ohio Rules of Civil Procedure. The Plaintiff reserves its right to oppose said motion. Said motion may only be granted if the requirements of Rule 60(B)(4) are satisfied and (1) Plaintiff agrees to the termination, or (2) uport a

demonstration by Defendant that the Work required to be performed by Defendant pursuant to this Consent Order has been completed.

XXIV. RESOLUTION OF INCONSISTENCIES

94. Should Defendant identify any inconsistencies among any of the laws, rules, regulations, guidance, permits or orders which will affect any of the Work required by this Consent Order, Defendant shall provide written identification to the Plaintiff of each such inconsistency, a description of its effect on the Work to be performed, and Defendant's recommendation, along with the rationale for each recommendation, as to which requirement should be followed. Defendant shall implement the affected Work based upon Ohio EPA's discretion in resolving any such inconsistencies.

95. Defendant's compliance with the orders or directions of State or Federal governmental officials in the exercise of such officials' legal authority shall not be deemed a violation of this Consent Order.

XXV. DELAYED PERFORMANCE

96. If any event occurs which causes or may cause a material and consequential delay in Defendant's compliance with any requirement identified in or pursuant to Section XIX [Stipulated Penalties], Defendant shall notify the Ohio EPA in writing within ten [10] days from when the Defendant knew, or by the exercise of due diligence should have known, of the delay. The notification to Ohio EPA shall describe in detail the anticipated length of the delay, the precise cause or causes of the delay, the measures taken and to be taken by the Defendant to prevent or minimize the delay,

and the timetable by which those measures will be implemented. Defendant shall adopt all reasonable measures to avoid or minimize any such delay.

XXVI. POTENTIAL OF FORCE MAJEURE

97. In any action by the State of Ohio to enforce any of the provisions of this Consent Order, Defendant may raise at that time the guestion of whether it is entitled to a defense that its conduct was caused by circumstances beyond its control or ability to control such as, by way of example and not limitations, acts of God, strikes, acts of war or civil disturbances. While the State of Ohio does not agree that such a defense exists, it is, however, hereby agreed upon by Defendant and the State of Ohio that it is premature at this time to raise and adjudicate the existence of such a defense and that the appropriate point at which to adjudicate the existence of such a defense is at the time, if ever, that a proceeding to enforce this Consent Order is commenced by the State. At that time, Defendant will bear the burden of proving that any delay was or will be caused by circumstances beyond the control or ability to control of Defendant. Unanticipated or increased costs associated with the implementation of any action required by this Consent Order, or changes in Defendant's financial circumstances, shall not constitute circumstances beyond the control or ability to control of Defendant. Failure by Defendant to timely comply with the notice requirements of Section XXIV [Delayed Performance] shall render this Section void and of no force and effect as to the particular incident involved and shall constitute a waiver of Defendant's right to request an extension of its obligations under this Consent Order based on such incident. An extension of one date based on a particular incident does not mean that

Defendant qualifies for an extension of a subsequent date or dates. Defendant must make an individual showing of proof regarding each incremental step or other requirement for which an extension is sought. Acceptance of this Consent Order without a Force Majeure Clause does not constitute a waiver of any rights or defenses that the Defendant may have under applicable law.

XXVII. CONTINUING JURISDICTION

98. This Court shall retain jurisdiction over this action for the purpose of enforcing and administering Defendant's compliance with this Consent Order.

XXVIII. ENTRY OF CONSENT ORDER AND FINAL JUDGMENT BY CLERK

99. The parties agree and acknowledge that final approval by Plaintiff and Defendant and entry of this Consent Order is subject to the requirements of 40 CFR 123.27(d)(2)(iii), which provides for notice of the lodging of the Consent Order, opportunity for public comment, and the consideration of any public comments. Both the State and the Defendant, reserve the right to withdraw this Consent Order prior to its entry by the Court as a final judgment based on comments received during the public comment period.

100. Upon signing of this Consent Order by the Court, the clerk is hereby directed to enter it upon the journal. Within three days after entering the judgment upon the journal, the clerk is hereby directed to serve upon the parties notice of the judgment and its date of entry upon the journal in the manner prescribed by Rule 5(B) of the Ohio Rules of Civil Procedure and note the service in the appearance docket.

IT IS SO ORDERED.

DATE

RICHARD E. PARROTT JUDGE, UNION COUNTY COURT OF COMMON PLEAS

APPROVED:

RICHARD P. FAHEY (0013131) KRISTIN L. WATT (0042333) Vorys, Sater, Seymour and Pease LLP 52 East Gay Street P.O. Box 1008 Columbus, Ohio 43216-1008 (614) 464-6400

Counsel for Defendant The Scotts Company

BETTY D. MONTGOMERY, ATTORNEY GENERAL OF OHIO

MARGARET A. MALONE (0021770) JOHN K. MCMANUS (0037140) Assistant Attorneys General Environmental Enforcement Section 30 East Broad Street, 25th Floor Columbus, Ohio 43215-3428 (614) 466-2766

Counsel for Plaintiff State of Ohio

THE SCOTTS COMPANY

By: David M. Aronowitz/Executive Vice President General Counsel and Corporate Secretary Authorized Representative of The Scotts Company THE IMAGE ON THE FOLLOWING PAGE SHOWS ONLY THE LEFT HAND SIDE OF THE DRAWING. SEE THE CONSENT ORDER BINDER TO VIEW THE ENTIRE DRAWING.



NAME: LAYDUTI-RINSCOTTSNC0033985N00NSITE.DVG DATE: AUG 23, 2000 TIME: 10:35 AM CTB: SNCTB PLDITINGNETSCOTTS.CTB

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Appendix B

OHIO EPA AND U.S. EPA GUIDANCE DOCUMENTS

Statement of Purpose and Use of This Guidance Document List:

The purpose of this list of Ohio EPA and U.S. EPA policies, directives and guidance documents is to provide a reference of the documents which provide essential direction and guidance for conducting investigations, evaluating alternative remedial actions, and designing and implementing selected remedial actions at sites for which the Division of Hazardous Waste Management has authority over such Correction Action activities. Certain sites may have contaminants or conditions which are not fully addressed by the documents in this list. There is an evolving body of policy directives, guidance and research documentation which should be utilized, as necessary, to address those conditions and contaminants not encompassed by the documents in this list.

OHIO EPA POLICIES AND GUIDANCE DOCUMENTS

- 1. Best Available Treatment Technologies (BATT) for Remedial Response Program Sites, Ohio EPA Policy No. DERR-00-RR-016, Final, October 23, 1992.
- 2. Closure Plan Review Guidance for RCRA Facilities, March, 1999.
- 3. Ohio Corrective Action Plan. January 1997. Internet address: http://www.epa. ohio.gov/dhwm/welcome.html
- 4. Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring Programs, Ohio EPA, Division of Drinking and Ground Waters, Final, February 1995.
- 5. Wastewater Discharges Resulting from Clean-Up of Response Action Sites Contaminated with Volatile Organic Compounds, Ohio EPA Policy No. DSW-DERR 0100.027, Final, September 22, 1994.

If there are any aquatic ecological concerns identified during the RFI phase for the site under investigation please consult the following Biological Criteria documents:

 Biological Criteria for the Protection of Aquatic Life: Volume I. The Role of Biological Data in Water Quality Assessment. Ohio EPA, Division of Surface Water, 1987.

- 7. Biological Criteria for the Protection of Aquatic Life: Volume II. Users Manual for Biological Field Assessment of Ohio Surface Waters. Ohio EPA, Division of Surface Water, 1987.
- Addendum to Biological Criteria for the Protection of Aquatic Life: Volume II. Users Manual for Biological Field Assessment of Ohio Surface Waters. Ohio EPA, Division of Surface Water, 1989.
- 9. Biological Criteria for the Protection of Aquatic Life: Volume III. Standardized Biological Field Assessment of Ohio Surface Waters. Ohio EPA, Division of Surface Water, 1989.
- 10. Rankin, E.T. 1989. The Qualitative Habitat Evaluation Index (QHEI): Rationale, Methods, and Application. Ohio EPA, Division of Surface Water, 1990.

U.S. EPA GUIDANCE DOCUMENTS AND OTHER USEFUL GUIDANCE

- 11. "Basics of Pump-and-Treat Ground Water Remediation Technology," EPA/600/8-90/003, March 1990.
- 12. "Bibliography of Federal Reports and Publications Describing Alternative and Innovative Treatment Technologies for Corrective Action and Site Remediation," EPA/540/8-91/007, May 1991.
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Appendix C

Approved RFI Workplan

RCRA FACILITY INVESTIGATION WORKPLAN

FOR

THE SCOTTS COMPANY

June 11, 1999

F.ECEIVED JUN 2 2 2000 OHIO EPA/CDO

Submitted To:

OHIO ENVIRONMENTAL PROTECTION AGENCY Division of Hazardous Waste Management Central District Office

Prepared by:

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION 4900 Blazer Parkway Dublin, Ohio 43017



Dublin, Ohio

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LIST OF ACRONYMS AND ABBREVIATIONS

amsl	above mean sea level
ARAR	Applicable or Relevant and Appropriate
AST	Above Ground Storage Tank
ATSDR	Agency of Toxic Substances and Disease Registry
AWQC	Ambient Water Quality Criteria
B&N	Burgess & Niple, Limited
BAF	Bioaccumulation Factor
BERA	Baseline Ecological Risk Assessment
BCF	Bioconcentration Factor
bgs	below ground surface
bls	below surface
BRA	Baseline Risk Assessment
CA	Corrective Actions
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CLP	Contract Laboratory Protocol
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
COC	Contaminants of Concern
COC	Chain of Custody
COPC	Contaminants of Potential Concern
CR	Crosses Run
СТР	Corrective Technology Plan
DAF	Dilution Attenuation Factor
DOCC	Description of Current Conditions
DPT	Direct Push Technology
DQO	Data Quality Objectives
ecoCOC	ecological Chemicals of Concern
ELCR	Excess Lifetime Cancer Risk
EPA	U.S. Environmental Protection Agency
EQL	Estimated Quantitation Limit
ER-L	Effects Range-Low
ER-M	Effects Range-Median
ERA	Ecological Risk Assessment
FBA	Field Broadcast Area
FCO	Field Change Order
FSP	Field Sampling Plan
ft.	Feet
gpd	gallons per day
gpm	gallons per minute
HASP	Health & Safety Plan
HEAST	Health Effects and Assessment Summary Tables
HHRA	human health risk assessment
HI	Hazard Index
HQ	Hazard Quotient

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RCRA FACILITY INVESTIGATION WORK PLAN FOR THE SCOTTS COMPANY JUNE 11, 1999

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HSA	Hollow Stem Auger
IRIS	Integrated Risk Information System
IU	Investigative Unit
K	Kydraulic conductivity
LCS	Laboratory Control Sample
LLDPE	Linear Low-density Polyethylene
LOAEL	Lowest Observable Adverse Effect Level
LOR	Letter of Receipt
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
MS/MSD	Matrix spike/Matrix spike duplicate
msl	mean sea level
MW	Monitoring Well
NAWQC	National Ambient Water Quality Criteria
NCEA	National Center for Environmental Assessment
NCR	Nonconformance Report
NIST	National Institute of Standards and Testing
NOAEL	No Observable Adverse Effect Level
NPDES	National Pollution Discharge and Elimination System
NWI	National Wetland Inventory
OCAP	Ohio EPA Corrective Action Program
OD	Outside Diameter
ODNR	Ohio Department of Natural Resources
ODOT	Ohio Department of Transportation
OEPA	Ohio Environmental Protection Agency
OSWER	Office of Solid Waste and Emergency Response
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PIP	Public Involvement Plan
ppb	part per billion
ppm	part per million
PQL	Practical Quantitation Limit
PRG	Preliminary Remediation Goal
QA	Quality Assurance
QAP	Quality Assurance Plan
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
QCSR	Quality Control Summary Report
RAGS	Risk Assessment Guidance for Superfund
RCB	Risk-based Concentrations
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
RM	River Mile
RME	Reasonable Maximum Exposure
RPD	Relative Percent Difference
RTECS	Registry of Toxic effects of Chemical Substances
SAIC	Science Applications International Corporation

RCRA FACILITY INVESTIGATION WORK PLAN FOR THE SCOTTS COMPANY JUNE 11, 1999

SDG	Sample Delivery Group
SOP	Standard Operating Procedures
SOW	Statement of Work
SHSO	Site Health & Safety Officer
SHSP	Site Health & Safety Plan
SF	Slope Factor
SS	Surface Sediment
SVOC	Semi-Volatile Organic Compound
SW	Surface Water
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TW	Test Well
UCL	Upper Confidence Limit
µg/kg	micrograms per kilogram
USCS	Unified Soil Classification System
UST	Underground Storage Tank
UTL	Upper Tolerance Limit
VAP	Voluntary Action Program
VOC	Volatile Organic Compound
WWH	Warm Water Habitat
WWTP	Waste Water Treatment Plant

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EXECUTIVE SUMMARY JUNE 11, 1999 (REVISED JANUARY 21, 2000) RFI WORK PLAN FOR THE SCOTTS COMPANY MARYSVILLE, OHIO

This Work Plan describes the investigation activities necessary to satisfy the requirements for a RCRA Facility Investigation (RFI) at the Scotts Company Marysville facility. The RFI is a requirement of the Consent Order between Scotts and the Ohio Environmental Protection Agency (Ohio EPA) as represented by their council, the Ohio Attorney Generals Office.

The purpose of this RFI is to evaluate thoroughly the nature and extent of the releases or threat of release of hazardous waste and hazardous constituents (primarily chlordane at Scotts) at thirteen (13) Investigative Units at the Scotts Marysville facility as delineated under the Consent Order. The Investigative Units considered are:

Landfill 1	Former Pond 2
Landfill 2	Former Pond 3
Landfill 3	Former Pond 6
Landfill 4	Former Pond 7
Landfill 5	Former Pond 8
Field Broadcast Area 1	Crosses Run (Selected Portions)
Field Broadcast Area 2	· · · · · · · · · · · · · · · · · · ·

This document follows the requirements of the Ohio EPA's Corrective Action Program (OCAP), which identifies ten elements that should be part of a complete RFI work plan. Nine of these ten elements are included as sections with this work plan, as summarized below:

- Description of Current Conditions (a current and accurate representation of the environmental conditions);
- Objectives of the Investigation (delineates the goals of the RFI);
- Field Sampling Plan (defines the procedures to be implemented in the field);
- Quality Assurance Plan and procedures (field and laboratory procedures that must be adhered to in order to collect, analyze, verify, and assure the quality of the data gathered);
- Health and Safety Plan (health and safety procedures to be adhered to during field work);
- Data Management Plan (how data collected in the field will be processed, analyzed, and presented);
- Project Management Plan (establishes the principle teams responsible for conducting the RFI);
- Public Involvement Plan (describes how the facility will involve the public during the investigation and throughout the corrective action program);
- Schedule of Activities/submittal of deliverables (timetable for completing milestones of the RFI); and
- Corrective Technology Plan (evaluates and considers additional information that may be required to adequately evaluate remedial action alternatives). This element has been removed from this Work Plan as requested by Ohio EPA in their comment letter dated January 21, 2000.

A tenth element, called the Baseline Risk Assessment Methodology, is also included in this RFI work plan. This section delineates key assumptions used in the estimation of risk, including land use, exposure assumptions, derivation of lists of contaminants of potential concern (COPCS), and identification of target receptors and indicator species. While not specifically called out in OCAP, this section has been added to the RFI work plan in order to involve and solicit input from Ohio EPA risk assessors in the early stage of the RFI planning, and reach agreement on the methodology that will be used to complete the Baseline Risk Assessment (BRA).

The investigation activities outlined in the field sampling plan are the most critical element of the RFI work plan. They are designed to compliment the extensive sampling already conducted at the Scotts Marysville facility. Proposed sampling locations have been determined based on a comprehensive review of the existing data (as described in the description of current conditions) and detailed evaluation of site conditions (i.e., site geology, hydrogeology, localized topography, and past and current site activities).

This work plan proposes twenty-eight (28) direct push technology (DPT) borings, fifteen (15) hand auger samples, forty-seven (47) surface soil samples, twenty-seven (27) subsurface samples (for chemical analysis), eighteen (18) geotechnical samples, and the potential installation of thirteen (13) groundwater monitoring wells at the landfills, field broadcast areas and former ponds. In addition, thirteen (13) surface water and twenty-one (21) sediment samples are proposed for Crosses Run. A summary of the planned investigation activities and potential remedial options for each of the thirteen units at the Scotts facility is presented below.

Landfill 1

Two DPT samples will be collected to determine potential for a near-surface perched groundwater zone that may be flowing back towards Crosses Run from Landfill 1. If shallow saturated seams are encountered in the DPTs then a monitoring well will be advance in one of the DPT locations. Quarterly groundwater monitoring will continue in existing wells located adjacent to Landfill 1.

Landfill 1 was closed in August 1998. Therefore no further action is anticipated at this unit other than continued groundwater monitoring.

Landfill 2

To evaluate migration of water directly from the landfill to adjacent Crosses Run, the embankment vegetation will be removed along the length of the landfill. Five (5) hand-augers will be advanced between the landfill and Crosses Run Creek to further delineate the limits of fill. Three (3) DPTs will be advanced within the fill limits of the landfill to characterize existing conditions.

Potential remedial alternatives for this unit include soil cover and groundwater monitoring or soils consolidation, soil cover, and groundwater monitoring. Potentially contaminated sediments in Crosses Run next to this landfill may be excavated, dewatered, placed on top of the existing landfill and covered.

Landfill 3

The nature and extent of contamination on the southwest side of the highway outside of the right of way will be evaluated through two hand auger sample locations. Six (6) hand-augers will be advanced between the landfill and the northeast edge of the ditch along U.S. Route 33 to further delineate the limits of fill. Two (2) DPTs will be advanced within the fill limits of the landfill to characterize existing conditions.

ODOT will be responsible for the remediation of contamination within the right-of-way along State Route 33. Scotts has responsibility for portions of the landfill not in the right-of-way. Remedial alternatives will be determined after the investigation of this unit has been completed. One possible remedial alternative is placement of soil cover over the impacted area and continued groundwater monitoring. Closure activities should be coordinated with ODOT.

Landfill 4

Two DPT borings will be advanced outside the limits of the fill area to determine the existence of localized shallow saturated seams that may exist between Landfill 4 and Crosses Run. If shallow saturated seams are encountered in the DPTs then a monitoring well will be advanced in one of the DPT locations. One (1) DPT will be advanced within the fill limits of the landfill to characterize existing conditions. Quarterly groundwater monitoring will continue in existing wells located adjacent to Landfill 4.

A potential remedial alternative for this unit is soil cover and groundwater monitoring. Potentially contaminated sediments in Crosses Run next to this landfill may be excavated, dewatered, placed on top of the existing landfill and covered.

Landfill 5

Two DPT borings will be advanced outside the limits of the fill area to determine the existence of localized shallow saturated seams that may exist between Landfill 5 and Crosses Run. If shallow saturated seams are encountered in the DPTs then a monitoring well will be advance in one of the DPT locations. Two (2) hand augers will be advanced immediately to the south of the property line bounding the southern end of the landfill to further delineate the limits of fill. Two (2) DPTs will be advanced within the fill limits of the landfill to characterize existing conditions. Quarterly groundwater monitoring will continue in existing wells located next adjacent to Landfill 5.

Potential remedial alternatives for this unit include soil cover and groundwater monitoring or soils consolidation, soil cover, and groundwater monitoring. Potentially contaminated sediments in Crosses Run next to this landfill may be excavated, dewatered, placed on top of the existing landfill and covered.

Field Broadcast Area 1

Two DPT borings will be advanced outside the limits of the fill area to determine the existence of localized shallow saturated seams that may exist between Field Broadcast Area 1 and Crosses Run. If shallow saturated seams are encountered in the DPTs then a monitoring well will be advanced in one of the DPT locations. One (1) groundwater monitoring well will be installed along the east side of FBA 1, next to the railroad tracks (Figure 4.5). This monitoring well will characterize the possible extent of groundwater contamination in the regional upper most saturated zone. If a hydrologically significant shallow saturated zone(s) is encountered while drilling the primary monitoring well, then at that time, nesting of a shallow monitoring well at this location will be evaluated. Eight (8) surface soil samples will be collected from this unit to provide a statistically significant sampling population for risk assessment purposes to support no further action at this site. Quarterly groundwater monitoring will continue in existing wells located next adjacent to Field Broadcast Area 1.

Based on a preliminary evaluation of existing data from this unit, no action may be necessary at Field Broadcast Area 1. This alternative will be dependent on the outcome of the Human Health and Ecological Risk Assessment of existing and newly collected sampling information. Other potential remedial alternatives for this unit include soil cover and groundwater monitoring or soils consolidation, soil cover, and groundwater monitoring.

Field Broadcast Area 2 (Including Former Ponds 7 and 8)

One (1) groundwater monitoring well is proposed to be installed in FBA 2. This well will be placed in the north corner of the area and will serve as the upgradient (and background) monitoring well.

Three (3) DPT borings will be advanced outside the limits of the fill area to determine the existence of localized shallow saturated seams that may exist between Field Broadcast Area 2 and Crosses Run. If shallow saturated seams are encountered in the DPTs then a monitoring well will be advanced in one of the DPT locations. Two (2) additional DPTs are proposed to be advanced within the limits of FBA 2 and within the two former ponds. These DPTs will be placed in the middle of Former Ponds 7 and 8 to characterize existing conditions. Eight (8) surface soil samples will be collected from this unit to provide a statistically significant sampling population for risk assessment purposes to support no further action at this site. Quarterly groundwater monitoring will continue in existing wells located next adjacent to Field Broadcast Area 2.

Based on a preliminary evaluation of existing data from this unit, no action may be necessary at Field Broadcast Area 2. This alternative will be dependent on the outcome of the Human Health and Ecological Risk Assessment of existing and newly collected sampling information. Other potential remedial alternatives for this unit include soil cover and groundwater monitoring or soils consolidation, soil cover, and groundwater monitoring.

Former Pond 2

Two DPT borings will be advanced and sampled to characterize existing conditions within the limits of the pond. In addition, one DPT will be advanced outside the limits of the pond to determine the existence of localized shallow saturated seams that may exist down gradient of Pond 2. If shallow saturated seams are encountered in the DPT then a monitoring well will be advanced. Eight (8) surface soil samples will be collected from this unit to provide a statistically significant sampling population for risk assessment purposes to support no further action at this site. Five additional subsurface samples will be collected from the ditch that formerly connectd Pond 2 with Pond 1. Quarterly groundwater monitoring will continue in existing wells located adjacent to Former Pond 2.

Based on a preliminary evaluation of existing data from this unit, no action other than continued groundwater monitoring may be necessary at Former Pond 2. This alternative will be dependent on the outcome of the Human Health and Ecological Risk Assessment of existing and newly collected sampling information. Another potential remedial alternative for this unit includes soil cover and groundwater monitoring.

Former Pond 3

Two DPT borings will be advanced and sampled to characterize existing conditions within the limits of Former Pond 3. In addition, one DPT will be advanced outside the limits of the pond between the pond and the north branch of Crosses Run to determine the existence of localized shallow saturated seams. If shallow saturated seams are encountered in the DPT then a monitoring well will be advanced. Six (6) surface soil samples will be collected from this unit to provide a statistically significant sampling population for risk assessment purposes to support no further action at this site.

No action may be appropriate at Former Pond 2. This alternative will be dependent on the outcome of the Human Health and Ecological Risk Assessment of existing and newly collected sampling information. Another potential remedial alternative for this unit includes soil cover and groundwater monitoring.

Former Pond 6

One DPT boring will be advanced and sampled to characterize existing conditions within the limits of Former Pond 6. Five (5) surface soil samples will be collected from this unit to provide a statistically significant sampling population for risk assessment purposes to support no further action at this site.

No action may be appropriate at Former Pond 2. This alternative will be dependent on the outcome of the Human Health and Ecological Risk Assessment of existing and newly collected sampling information. Another potential remedial alternative for this unit includes soil cover and groundwater monitoring.

Crosses Run

Surface water and sediment samples will be collected from twenty-two (22) locations in Crosses Run and its' tributaries. Twelve of the samples will be collected from background locations to establish background concentrations for statistical and risk assessment calculations. Eight locations will be sampled to further delineate contaminant plumes from the landfills. Sediment samples will be taken from surface to 2 inches and from 6 to 24 inches in depth from these locations to establish information of vertical extent of contamination.

A potential remedial activity for reducing risks to human health and the environment from stream sediments is excavation, dewatering and placement/covering in another unit undergoing closure (Landfills 2, 4 and 5). However, the best strategy may be to implement point source controls, i.e., cap the landfills to prohibit further migration of contaminant material into the streams, and then allow natural attenuation to diminish risks associated with the identified contaminants. In some stream segments, natural attenuation may not be acceptable where contaminants pose substantial risks to aquatic life, wildlife and human health. This will also be evaluated during the risk assessment stage.

Background Sample Locations

Background Soil Samples

Twelve (12) surface soil samples will be collected on the Scotts company property at locations where company activities have not impacted the soils. The background soil analytical results will be used to develop baseline values for the risk assessment.

Background Groundwater Sample Locations

The background groundwater samples will be collected from monitoring wells that are upgradient to and not influenced by facility operations. The background groundwater monitoring wells will be screened in the regional upper most saturated zone, which represents the water bearing zone that is most prevalent and, therefore, possesses the potential for the most impact.

Three (3) background groundwater monitoring wells will be installed on the Scott's property, as shown on Figure 4.8. The upgradient groundwater monitoring well located north of FBA 2 will serve as a background well. Another well is located just to the east of the west property line on the south side of Industrial Parkway. The third is located in the northwest corner of the property, north of State Route 33.

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Section 1 Introduction

INTRODUCTION

SECTION 1

RCRA FACILITY INVESTIGATION WORK PLAN

FOR

THE SCOTTS COMPANY 14111 Scottslawn Road Marysville, Ohio 43041

June 11, 1999 (Revised January 21, 2000)

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RCRA Facility Investigation Work Plan For The Scotts Company June 11, 1999 (Revised January 21, 2000)

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1.0 INTRODUCTION

1.1 BACKGROUND

The purpose of this Work Plan is to describe the investigation activities necessary to satisfy the requirements for a RCRA Facility Investigation (RFI) at The Scotts Company Marysville facility. The RFI is a requirement of the Consent Order between Scotts and the Ohio Environmental Protection Agency (Ohio EPA) as represented by their council, the Ohio Attorney Generals Office.

The Scotts Company operates a large facility located on approximately 730 acres approximately 12 miles northwest of Columbus, Ohio on Scottslawn Road in Marysville, Ohio. This facility is used for the formulations of various fertilizers, herbicides, and pesticides. It includes areas where treatment, storage, placement, and disposal of hazardous, industrial, and solid waste have occurred.

This RFI for the Scotts facility is limited to thirteen investigative units (IUs), as detailed below:

- 1) Landfill 1
- 2) Landfill 2
- 3) Landfill 3
- 4) Landfill 4
- 5) Landfill 5
- 6) Field Broadcast Area 1
- 7) Field Broadcast Area 2
- 8) Former Pond 7 (this unit is contained within Field Broadcast Area 2 and will be investigated as part of Field Broadcast Area 2)
- 9) Former Pond 8 (this unit is contained within Field Broadcast Area 2 and will be investigated as part of Field Broadcast Area 2)
- 10) Former Pond 2
- 11) Former Pond 6
- 12) Former Pond 3
- 13) Crosses Run (selected portions)

The landfills, field broadcast areas and former ponds are no longer actively used. These units have surface contamination and/or potential source areas that may contribute to surface water/sediment contamination of Crosses Run (see Section 2 for a detailed description of the units). An additional 32 units at the Scotts Company were evaluated as part of a Phase 1 Environmental Site Assessment (Burgess and Niple, 1997) that was conducted in accordance with Ohio EPA Voluntary Action Program (VAP) protocol. These were listed as areas of potential releases, however no documented releases are known to have occurred from these units and they are not included within the scope of this RFI. The Scotts Company plans to investigate these units at a later date. The 32 units include the following:

- The Research and Development Center an active facility located north of Scottslawn Road.
- North Test Plots an active facility located adjacent to the Research and Development Center.
- Research and Development Test Plots active plots used for growing hybrid grasses and testing of Scotts products.

- The Trionize Plant an active facility that formulates products containing nitrogen, phosphorous, and potash, the major components in fertilizer.
- The Transport Area an active facility located on the southeast side of the Trionize Plant used for the shipping of product.
- The Hazardous Waste Storage Building (Old and New) an active facility used for the interim storage of cardboard gaylords containing floor sweepings, baghouse dust, and off-spec fertilizer characterized as hazardous waste.
- The Polyform Plant an inactive facility that formulated polyform and Poly-S fertilizer. A portion of the old building was refurbished and a new addition was added that is now referred to as the Trionize System 3 Process.
- The Polyform Test Plots active plots that are located west of the Polyform Plant that are used for the testing of polyform fertilizer and Poly-S.
- The Machine Shop an active facility that is located north of the Polyform Plant.
- AST Tank Farm an active tank farm located north of the Polyform Plant that contains one sulfuric acid tank, two hexylene glycol tanks, five urea formaldehyde tanks, two polyvis tanks, one solvac tank, and two water tanks.
- Eleven (11) Underground Storage Tanks (USTs) USTs which contained gasoline, fuel oil, solvac, and wastewater that were removed or closed in place during the mid 1980s.
- Four (4) sanitary, nonprocess water/waste water treatment package plants inactive facilities that are located on the property.
- Pond 1closed pond used for the settling of fertilizer solids collected from some manufacturing processes and used in the recycle systems.
- Five (5) active ponds and above ground storage tanks (ASTs) (Pond 3, Pond 4, Pond 4A, (ASTs) 5, and (ASTs) 5A) active ponds used for the settling of fertilizer solids collected from some manufacturing processes and used in the recycle systems.
- Off-site sources sources from the waterways and unnamed tributaries which flow into the Scotts property.
- Laboratory Less-Than-90 Day Accumulation Area.

The purpose of this RFI is to evaluate thoroughly the nature and extent of the releases or threat of release of hazardous waste and hazardous constituents at the thirteen investigative units at the Scotts Marysville facility. RCRA Corrective Action is a comprehensive program that typically begins with an evaluation of the site conditions and concludes with implementation of necessary corrective measures to remediate contamination at the site. The stated goal of Ohio EPA's Corrective Action Program (OCAP) is "to evaluate the nature and extent or threat of release of hazardous waste or constituents; to evaluate relevant facility characteristics...; and to identify, develop and implement the appropriate corrective measure or measures adequate to protect human health and the environment" (Ohio EPA, Corrective Action Program Guidance).

The investigation activities outlined in this RFI Work Plan are designed to compliment the extensive sampling already conducted at the Scotts Marysville facility. Proposed sampling locations have been determined based on a comprehensive review of the existing data and detailed evaluation of site conditions (i.e., site geology, hydrogeology, localized topography, and past and current site activities).

1.2 REPORT ORGANIZATION

The OCAP guidance identifies ten elements that should be part of a complete RFI Work Plan. These ten elements are:

- Description of Current Conditions,
- Objectives of the Investigation,
- Field Sampling Plan,
- Quality Assurance Plan and Procedures,
- Health and Safety Plan,
- Data Management Plan,
- Project Management Plan,
- Public Involvement Plan,
- Schedule of Activities/Submittal of Deliverables, and
- Corrective Technology Plan.

Nine of these ten elements are included as separate sections in this RFI Work Plan. This Work Plan also contains a tenth element, called the Baseline Risk Assessment Methodology. A brief description of the ten elements that compose the remainder of this Work Plan is provided below.

Section 2 Description of Current Conditions (DOCC) provides a current and accurate representation of the environmental conditions at Scotts. This section contains a facility-wide discussion, which describes the operations of the facility, the geophysical setting, the surrounding land use, and the ecological setting. This section also presents unit-specific information for the thirteen investigative units identified in Section 1.1. This discussion includes a description of the investigative unit, the unit's history, the current understanding of the nature and extent of contamination at the unit, and what, if any, interim measures have already been implemented at the unit.

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Section 6 *Health and Safety Plan* (HASP) describes the procedures that must be adhered to during implementation of the FSP in order to ensure the health and safety of the workers, surrounding community, and all other persons who may be on the investigation site during the investigation.

Section 7 Data Management Plan describes how data collected in the field will be processed, analyzed, and presented. Electronic data management and data validation are some of the elements discussed in the Data Management Plan.

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Section 9 *Project Management Plan* establishes the principle teams responsible for conducting the RFI. This plan also describes the qualifications and responsibilities of the lead personnel from each of these teams. Resumes of the project manager(s) and field manager(s) are also included.

Section 10 *Public Involvement Plan* describes how Scotts will involve the public during the investigation and throughout the Corrective Action process.

Section 11 Schedule of Activities / Submittal of Deliverables establishes the timetable for completing milestones of the RFI.

Corrective Technology Plan, also an element of the OCAP, was removed from this work plan as requested by Ohio EPA in their comment letter dated January 21, 2000.

INTRODUCTION

SECTION 1

RCRA FACILITY INVESTIGATION WORK PLAN

FOR

THE SCOTTS COMPANY 14111 Scottslawn Road Marysville, Ohio 43041

June 11, 1999 (Revised January 21, 2000)

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1.0 INTRODUCTION

1.1 BACKGROUND

The purpose of this Work Plan is to describe the investigation activities necessary to satisfy the requirements for a RCRA Facility Investigation (RFI) at The Scotts Company Marysville facility. The RFI is a requirement of the Consent Order between Scotts and the Ohio Environmental Protection Agency (Ohio EPA) as represented by their council, the Ohio Attorney Generals Office.

The Scotts Company operates a large facility located on approximately 730 acres approximately 12 miles northwest of Columbus, Ohio on Scottslawn Road in Marysville, Ohio. This facility is used for the formulations of various fertilizers, herbicides, and pesticides. It includes areas where treatment, storage, placement, and disposal of hazardous, industrial, and solid waste have occurred.

This RFI for the Scotts facility is limited to thirteen investigative units (IUs), as detailed below:

- 1) Landfill 1
- 2) Landfill 2
- 3) Landfill 3
- 4) Landfill 4
- 5) Landfill 5
- 6) Field Broadcast Area 1
- 7) Field Broadcast Area 2
- 8) Former Pond 7 (this unit is contained within Field Broadcast Area 2 and will be investigated as part of Field Broadcast Area 2)
- 9) Former Pond 8 (this unit is contained within Field Broadcast Area 2 and will be investigated as part of Field Broadcast Area 2)
- 10) Former Pond 2
- 11) Former Pond 6
- 12) Former Pond 3
- 13) Crosses Run (selected portions)

The landfills, field broadcast areas and former ponds are no longer actively used. These units have surface contamination and/or potential source areas that may contribute to surface water/sediment contamination of Crosses Run (see Section 2 for a detailed description of the units). An additional 32 units at the Scotts Company were evaluated as part of a Phase 1 Environmental Site Assessment (Burgess and Niple, 1997) that was conducted in accordance with Ohio EPA Voluntary Action Program (VAP) protocol. These were listed as areas of potential releases, however no documented releases are known to have occurred from these units and they are not included within the scope of this RFI. The Scotts Company plans to investigate these units at a later date. The 32 units include the following:

- The Research and Development Center an active facility located north of Scottslawn Road.
- North Test Plots an active facility located adjacent to the Research and Development Center.
- Research and Development Test Plots active plots used for growing hybrid grasses and testing of Scotts products.

- The Trionize Plant an active facility that formulates products containing nitrogen, phosphorous, and potash, the major components in fertilizer.
- The Transport Area an active facility located on the southeast side of the Trionize Plant used for the shipping of product.
- The Hazardous Waste Storage Building (Old and New) an active facility used for the interim storage of cardboard gaylords containing floor sweepings, baghouse dust, and off-spec fertilizer characterized as hazardous waste.
- The Polyform Plant an inactive facility that formulated polyform and Poly-S fertilizer. A portion of the old building was refurbished and a new addition was added that is now referred to as the Trionize System 3 Process.
- The Polyform Test Plots active plots that are located west of the Polyform Plant that are used for the testing of polyform fertilizer and Poly-S.
- The Machine Shop an active facility that is located north of the Polyform Plant.
- AST Tank Farm an active tank farm located north of the Polyform Plant that contains one sulfuric acid tank, two hexylene glycol tanks, five urea formaldehyde tanks, two polyvis tanks, one solvac tank, and two water tanks.
- Eleven (11) Underground Storage Tanks (USTs) USTs which contained gasoline, fuel oil, solvac, and wastewater that were removed or closed in place during the mid 1980s.
- Four (4) sanitary, nonprocess water/waste water treatment package plants inactive facilities that are located on the property.
- Pond 1 closed pond used for the settling of fertilizer solids collected from some manufacturing processes and used in the recycle systems.
- Five (5) active ponds and above ground storage tanks (ASTs) (Pond 3, Pond 4, Pond 4A, (ASTs) 5, and (ASTs) 5A) active ponds used for the settling of fertilizer solids collected from some manufacturing processes and used in the recycle systems.
- Off-site sources sources from the waterways and unnamed tributaries which flow into the Scotts property.
- Laboratory Less-Than-90 Day Accumulation Area.

The purpose of this RFI is to evaluate thoroughly the nature and extent of the releases or threat of release of hazardous waste and hazardous constituents at the thirteen investigative units at the Scotts Marysville facility. RCRA Corrective Action is a comprehensive program that typically begins with an evaluation of the site conditions and concludes with implementation of necessary corrective measures to remediate contamination at the site. The stated goal of Ohio EPA's Corrective Action Program (OCAP) is "to evaluate the nature and extent or threat of release of hazardous waste or constituents; to evaluate relevant facility characteristics...; and to identify, develop and implement the appropriate corrective measure or measures adequate to protect human health and the environment" (Ohio EPA, Corrective Action Program Guidance).

The investigation activities outlined in this RFI Work Plan are designed to compliment the extensive sampling already conducted at the Scotts Marysville facility. Proposed sampling locations have been determined based on a comprehensive review of the existing data and detailed evaluation of site conditions (i.e., site geology, hydrogeology, localized topography, and past and current site activities).

1.2 REPORT ORGANIZATION

The OCAP guidance identifies ten elements that should be part of a complete RFI Work Plan. These ten elements are:

- Description of Current Conditions,
- Objectives of the Investigation,
- Field Sampling Plan,
- Quality Assurance Plan and Procedures,
- Health and Safety Plan,
- Data Management Plan,
- Project Management Plan,
- Public Involvement Plan,
- Schedule of Activities/Submittal of Deliverables, and
- Corrective Technology Plan.

Nine of these ten elements are included as separate sections in this RFI Work Plan. This Work Plan also contains a tenth element, called the Baseline Risk Assessment Methodology. A brief description of the ten elements that compose the remainder of this Work Plan is provided below.

Section 2 Description of Current Conditions (DOCC) provides a current and accurate representation of the environmental conditions at Scotts. This section contains a facility-wide discussion, which describes the operations of the facility, the geophysical setting, the surrounding land use, and the ecological setting. This section also presents unit-specific information for the thirteen investigative units identified in Section 1.1. This discussion includes a description of the investigative unit, the unit's history, the current understanding of the nature and extent of contamination at the unit, and what, if any, interim measures have already been implemented at the unit.

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Section 2 DOCC

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DESCRIPTION OF CURRENT CONDITIONS

SECTION 2

RCRA FACILITY INVESTIGATION WORK PLAN

FOR

THE SCOTTS COMPANY 14111 Scottslawn Road Marysville, Ohio 43041

June 11, 1999

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2.0 DESCRIPTION OF CURRENT CONDITIONS

The Description of Current Conditions (DOCC) provides a current representation of the environmental conditions at the thirteen investigative units (IUs) considered under this investigation. A significant amount of investigation has been conducted at these IUs that allows a fairly accurate description of the nature and extent of contamination at the units. Initially, a general description of the nature and extent of the features of the facility is presented. A subsequent in-depth discussion of each unit considered under this investigation follows.

2.1. FACILITY-WIDE DESCRIPTION

This section contains a facility-wide description of the facility, including a discussion of the site history, operations of the facility, the geophysical setting, the surrounding land use, and the ecological setting.

Site Description

The Scotts Company blends raw materials into fertilizers and fertilizers with pesticides and herbicides at its' Marysville, Ohio facility. Construction began in 1955 with production beginning in 1957. Prior to that time the area was used for agricultural purposes. The Marysville facility consists of production areas, a warehouse and loading areas, research laboratories, office buildings, product test fields, and used land. The production processes at the facility are discussed below.

- 1. <u>Systems 1 & 2</u> Are located on the east side of the Conrail tracks and were formerly known as the Trionize Process. This process involves blending nitrogen, phosphorous, and potassium with a vermiculite or plant nutrient substrate. The material is sent through a rotating drum to achieve particle size, product qualities and remove moisture. Pesticides and herbicides are then applied as a coating to some of the fertilizer products which are allowed to dry before packaging.
- 2. <u>System 3</u> Is located on the west side of the Conrail tracks and was formerly known as the Polyform Process. This process uses the same raw materials as Systems 1&2, but does not use vermiculite as a substrate.
- 3. <u>The Ploy-S Process</u> Is located on the west side of the Conrail tracks. This process involves coating urea particles with sulfur and a polymer coating to produce a slow release fertilizer product.
- 4. <u>Polymer Encapsulation</u> Is located on the west side of the Conrail tracks and produces a slow release fertilizer product by coating fertilizer particles with a protective latex liquid.
- 5. <u>Bulk Blend</u> Is located on the west side of the Conrail tracks and involves mixing and blending of various fertilizer grades or fertilizers with pesticides to produce a fertilizer product or fertilizer/pesticide product.

Between 1956 and 1984, the facility disposed process wastes on site in five landfills and two broadcast areas (Field Broadcast Areas 1 and 2). The facility also used several ponds over the years for settling solids out of process waters prior to recycling the water back to the processes.

Site Geology

2.1.2.1 Regional Geology

The Scotts Marysville Facility is located within the Till Plains section of the Central Lowlands physiographic province. Topography varies from shallow valleys created by present-day drainage to broad till plains. The geologic deposits in this area consist of Pleistocene glacial till overlying Silurian bedrock.

The glacial deposits in the area are a type known as till. Till is material that was deposited directly by the glacier, and consists of an unstratified mixture of clay and silt, with minor amounts of sand and gravel. This material was deposited in front of the glacier, or under the ice sheet. Because it was often buried under the ice, till tends to be very compact, dense material, and is known as a ground moraine deposit when found in a broad plain. Till deposits are also found as small ridges and hills, which are known as end moraine deposits, because they are found where the edge of the glacier was once located. The Scotts Marysville Facility property is located in an area of ground moraine between the Powell end moraine to the south and the Broadway end moraine to the north. Between these two end moraines, the coarser glacial material was most likely deposited by meltwaters in thin discontinuous channels. These channels would be expected to have a general northeast-southwest orientation perpendicular to the end morraine. Subsequent glacial advances and retreats locally may have truncated these outwash channels.

Bedrock in the area consists of Silurian dolomite that is part of a sequence of rocks known as the Salina (undifferentiated). In general, the bedrock is found in layers that are nearly horizontal to gently dipping to the east. The Scotts Marysville Facility sits near the eastern edge of a regional anticline known as the Cincinnati Arch. This structural feature is why the bedrock dips slightly to the east. According to *Regional Bedrock Geology of the Bellefontaine, Ohio, 30 x 60 Minute Quadrangle* published by the Ohio Division of Geological Survey, no other major structural features are present in the area.

2.1.2.2 Local Geology

The topography of the surrounding area is shown on Plate 1 and Figure 2.1. As displayed, the topography in this area is relatively flat with minor relief in the vicinity of drainage features. Ground surface elevations range from approximately 955 feet above mean sea level (amsl) in the Landfill 3 vicinity to approximately 990 feet amsl in the Field Broadcast Area 2 vicinity.

Drilling conducted on the site encountered clay tills, which is consistent with previous work performed in the area. Cross Sections A-A' through F-F' show subsurface materials encountered in cross section (Plates 2A and 2B). The glacial deposits can be divided into two generalized units. From the surface to approximately 20 feet below ground surface (bgs) (950 feet above mean sea level [amsl]), glacial deposits consist mainly of clay rich till, with some vertical fracturing. Below 20 feet, the clay till material is still predominant; however, sporadic discontinuous layers of sand and gravel are present. The stratigraphic position of these sandy layers is variable, and there is no indication that they are laterally extensive. The thin layers of coarse material probably represent deposits as a result of sporadic meltwater streams formed during glacial advances and recessions. In this setting, numerous thin discontinuous sand and gravel layers are possible with many of the deposits truncated by subsequent glacial advances.

Plant Area

Plate 2A and Plate 2B show the geologic cross sections drawn through the plant area. Section D-D' is drawn in a SW-NE direction north of Ponds 5 and 5A. The boring log data obtained in the vicinity of Landfill 1 shows the sand layers are not interconnected. A well-sorted sand layer approximately 2 feet thick was encountered in MW-41 and MW-26 at an elevation of approximately 952 feet amsl. This sand layer was not encountered in nearby wells MW-25 and MW-42. This supports the model of sinuous, local tube-like sand deposits rather than laterally extensive sand layers. Cross Section C-C' is drawn in a NW-SE direction through the center of this area as shown on Plate 2A. This section shows the limestone bedrock surface based on the drill log for the Scotts production well. Limestone bedrock was encountered in this area at Elevation 907 feet amsl.

Landfills 4 and 5, Field Broadcast Area 1

The subsurface conditions in the vicinity of Landfill 4, Landfill 5 and Field Broadcast Area 1 are shown on Cross Sections A-A' and E-E' (Plates 2A and 2B). The lack of interconnection between the sand layers observed at the plant area is also evident in this area. The boring for MW-28 did not encounter any sand horizons above 935 feet amsl. Other borings in the area encountered sand horizons between 940 and 965 feet amsl. Shallow sand layers were encountered at MW-31 and MW-29.

Landfill 2

The subsurface conditions in the vicinity of Landfill 2 are shown on Cross Sections A-A' and B-B' (Plate 2A). The geologic conditions were similar to the conditions west of the railroad tracks with thin sand horizons encountered below 950 feet amsl that do not appear to be interconnected. These sand layers were encountered between Elevation 940 feet amsl and 950 feet amsl and consisted of medium to coarse silty sand. No shallow sand layers were encountered in the clay rich till layer between the ground surface and 950 feet amsl at Landfill 2.

Landfill 3

The subsurface conditions in the vicinity of Landfill 3 are shown on Cross Sections B-B' and F-F' (Plates 2A and 2B). The geologic conditions were more consistent in the vicinity of Landfill 3 than they were west of U.S. Route 33. Borings drilled in the vicinity of Landfill 3 encountered a sand layer between Elevation 940 and 950 feet amsl. The poorly sorted sand layers encountered in the borings for MW-33 and MW-32 are similar in appearance. The boring for MW-34 was not deep enough to confirm the presence of this layer. No sand layers were encountered in the clay rich till above 950 feet amsl.

Site Hydrogeology

2.1.3.1 Regional Hydrogeology

According to *Ground-Water Resources of Union County* published by the Ohio Department of Natural Resources (ODNR), the principal aquifer in the area is the limestone/dolomite bedrock, yielding up to 1,000 gallons per minute (gpm). An industrial water well located at the Scotts Marysville Facility property was developed in the bedrock at a depth of 200 feet. This well produces approximately 100,000 gallons per day (gpd). Another industrial supply well is located

at the Goodyear Tire & Rubber Company approximately 1/2 mile to the southeast of the Scotts Marysville Facility property. According to ODNR records, this well is 90 feet deep and pumps groundwater at a rate of 4,100 gpd. The water pumped at Goodyear is used for turf maintenance and fire protection. Well logs for former and current residential wells in the area indicate that they are also completed in the underlying bedrock. No well logs in the area indicate that any wells have been completed in the glacial materials for water supply purposes.

2.1.3.2 Local Hydrogeology

Drainage from the Scotts facility flows along the north and south branches of Crosses Run which join together near the intersection of Scottslawn Road and Industrial Parkway. The main branch of Crosses Run flows north through the Scotts park, under U.S. Route 33 and north of Landfill 3 toward Mill Creek.

Saturated conditions were first encountered at an approximate elevation of 960 feet amsl across the Scotts Marysville Facility site. The majority of the groundwater monitoring wells at the Scotts Marysville Facility are screened between 945 and 955 feet amsl in thin sand layers. Shallow saturated zones have been encountered in the vicinity of the wastewater treatment ponds, with depths ranging from approximately 10 to 15 feet bgs. Two monitoring wells have been screened in these shallow zones in the vicinity of Pond 3.

Water level elevations have been measured and evaluated over 10 independent events. Water levels have been measured in 22 monitoring wells installed by B&N across the site, and 6 wells installed by others in the late 1980s in the vicinity of Pond 1. Table 2.1 summarizes groundwater elevations observed over the 10 monitoring events. In addition, Table 2.1 displays the historical maximum, minimum, and average elevations calculated at each well. When the maximum and minimum values of each well are compared to one another, it is obvious that considerable fluctuation in groundwater elevations is seen across the entire facility. Groundwater fluctuates, in general, more than 4 feet across the site. Four hydrographs, included in Appendix A, also display the variability of groundwater elevations. Monitoring wells in each of the four waste disposal areas (Landfill 1/Field Broadcast Area 2, Landfill 2, Landfill 3, and Landfill 4 and 5/Field Broadcast Area 1) exhibit similar patterns of seasonal fluctuation, with maximum groundwater elevations recorded in May to June, and minimum elevations recorded in December.

The most recent round of groundwater elevations was collected on October 15, 1998. Plate 3 displays the groundwater flow direction across the Scotts facility. The results show a historically consistent groundwater flow direction to the southeast across the entire site. Groundwater elevation measurements have shown a fairly consistent hydraulic gradient of 0.0015 ft/ft.

Recharge in the area of the Scotts Marysville facility appears to be solely from precipitation, with the entire till plain as the recharge area. Previous work indicates that there is a downward vertical component in groundwater across the site (Gleason, 1985). This would be expected for precipitation recharge to the bedrock aquifer, as the water would have to migrate down through the glacial overburden. No local discharge area is apparent in the area of the Scotts Marysville facility. Mill Creek, located northeast of the property, was originally considered to be a potential groundwater discharge area prior to constructing the Scotts facility groundwater monitoring network. After consecutive interpretations of groundwater flow toward the southeast, Mill Creek is no longer considered as a discharge area for groundwater. Examination of a regional bedrock map indicates the possibility that the groundwater is flowing with the regional bedrock dip. Because of the relative lack of surface topography and the low permeability of the clay till, it is likely that no local flow cell has developed, and groundwater flow in the area of the Scotts Marysville facility is part of a larger regional flow cell. This being the case, it appears that the most likely discharge area for groundwater flow beneath the Scotts Marysville facility is the Scioto River, located approximately 12 miles to the east of the site.

Slug tests were conducted in March 1998 on eight monitoring wells: TW-8, TW-10B, MW-23, MW-28, MW-31, MW-37, MW-38, and MW-39 (B&N, 1998a). Results of the tests are presented in Table 2.2. The wells selected represent shallow sand material (TW-10B, MW-31, and MW-38), silty clay till (TW-8), and sand and gravel layers encountered at or below 950 feet amsl (MW-23, MW-28, MW-37, and MW-39). Hydraulic conductivity values for the silty clay range from 4.7×10^{-7} centimeters per second (cm/sec) to 6.0×10^{-6} cm/sec, and for the sandy layers range from 1.43×10^{-5} cm/sec to 3.27×10^{-3} cm/sec.

Plant Area

Plate 3 shows the groundwater elevations and flow directions in the plant area. The southerly groundwater flow direction shown on this sheet has been consistent through all the groundwater elevation measurement events conducted to date. Also typical is the general indication of a groundwater flow direction, with apparent local irregularities or inconsistency between water levels. This is another indication that the sand layers encountered are not interconnected and laterally extensive. The groundwater surface shown is the anticipated result of water level measurements obtained from poorly interconnected and laterally truncated, tube-like sand deposits.

Shallow saturated conditions were encountered in the vicinity of the plant in MW-38 and MW-40. These wells were installed in the vicinity of Pond 3. Groundwater was encountered in a thin sand layer at approximately 969 feet amsl in MW-38. Shallow saturated conditions were encountered in clayey gravel at approximately 975 feet amsl in MW-40. Wet conditions were also encountered in the waste materials in Landfill 1. The lower two feet of waste encountered in monitoring wells MW-41 and MW-42 was wet. However the silty clay beneath the fill was only slightly moist and the first aquifer was encountered 25 and 35 feet below the fill in MW-41 and MW-42, respectively. These wells were installed as double-cased wells near the south edge of Landfill 1. Table 2.3 presents a summary of the well installation details for all the wells at the Scotts Marysville facility.

Water level fluctuations from the dry season to the wet season in most of the wells at the plant area are generally within 2 feet (Table 2.1). Water level fluctuations in shallow well MW-38 are closer to 4 feet.

Landfills 4 and 5, Field Broadcast Area 1

Plate 3 shows the groundwater elevations and flow directions in the vicinity of Landfill 4, Landfill 5 and Field Broadcast Area 1. The easterly groundwater flow direction shown on this plate has been consistent through all the groundwater elevation measurement events conducted to date. Also typical is the general indication of a groundwater flow direction, with apparent local irregularities or inconsistency between water levels. This is another indication that the sand layers encountered are not interconnected and laterally extensive. The groundwater surface shown is the anticipated result of water level measurements obtained from poorly interconnected and laterally truncated, tube-like sand deposits.
Several of the borings in this area encountered shallow sand deposits above 950 feet amsl. MW-29, MW-31, and MW-35 all encountered shallow saturated zones. The shallow sand layer encountered apparently influences water levels in MW-31. Water levels in this well are approximately 10 feet higher than in wells MW-28, MW-35, and MW-36, which are all screened at the same elevation. Water levels in MW-29 and MW-31 generally show larger fluctuations in water levels than the deeper wells.

Landfill 2

Plate 3 shows the groundwater flow directions in the vicinity of Landfill 2. The southeasterly flow direction shown on this map has been consistent through all of the groundwater elevation measurements obtained to date. As with the areas evaluated west of the railroad tracks, the water levels do not represent saturated layers that are interconnected. Other than wet conditions in the top 2 feet of waste materials in MW-22, no shallow saturated zones above 950 feet amsl have been encountered.

Landfill 3

Plate 3 shows the groundwater flow directions in the vicinity of Landfill 3. The southerly to southeasterly groundwater flow direction shown on this sheet is fairly consistent of groundwater flow directions at Landfill 3. As with the other areas evaluated, the groundwater levels demonstrate local inconsistencies in water level, indicating a lack of interconnection in the saturated sand layers encountered. No shallow saturated zones have been encountered in the vicinity of Landfill 3.

Surrounding Land Use and Ownership

The majority of the surrounding land use is agricultural, with some areas of industrial and residential land use. The surrounding land use, including the names of the property owners and property lines, is shown on Figure 2.2. The major industrial facilities near The Scotts Company include Goodyear Tire and Rubber Co. and American Brake Shoe Co.

Utilities

Plate 1 display the utilities located across the Scotts Marysville facility. Utilities identified include water, sewer, and natural gas.

Location of Wells

Plate 1 shows the location of all past and present production and groundwater monitoring wells. The wells installed for previous investigations are depicted on Plate 1 with a smaller icon and font. The groundwater monitoring wells installed for the purposes of evaluating the nine IUs are depicted with the larger icon and font. Wells that appear shaded have been abandoned. Table 2.3 presents a summary of the well installation details for all the wells at the Scotts Marysville facility.

Drainage Features

Plate 1 shows the general topographic features of the Scotts Marysville facility. This sheet shows the waterways and surface water containment features. The main waterway present on the site is

Crosses Run, a small ephemeral stream that flows from west to east through the facility. The main branch of Crosses Run flows from west to east south of Scottslawn Road. North Branch Crosses Run enters the main branch at the intersection of Scottslawn Road and Industrial Parkway. This portion of the stream flows along the northeast edge of the employee parking lot and warehouse area.

Ecological Setting

2.1.8.1 Description of Major Habitat Types

Habitat in the vicinity of the Scotts Marysville facility is primarily limited to a narrow riparian corridor along portions of Crosses Run and a higher quality corridor along Mill Creek. Most of the forest habitat in the area consists of these riparian corridors. Plate 4 displays the wetlands, forested areas, and riparian corridor features in the vicinity of the Scotts Marysville facility. The headwater area of Mill Creek is characterized by the densest tree cover in the watershed. A greater concentration of this forest cover occurs as a narrow riparian corridor which proceeds downstream along Mill Creek and eventually to Crosses Run. The majority of Crosses Run that flows through Scotts Marysville property lacks any forested habitat and is bounded by maintained grass banks. Remaining woodlands located in the area are typical of those existing in Union County, consisting of small, widely scattered woodlots.

Aquatic habitat in the area is limited primarily to Crosses Run and Mill Creek (Plate 4). Crosses Run is an intermittent drainage way and typically does not contain water in headwater areas during seasonal dry periods. A few potential natural wetlands are identified on the National Wetland Inventory (NWI) covering Crosses Run and Mill Creek in the vicinity of Scotts property. These areas are characterized as palustrine emergent wetlands which are temporarily flooded (PEMA) and palustrine forested wetlands which are seasonally flooded (PFOIC). The remaining wetland systems identified on the NWI maps on or in the vicinity of Scotts Marysville property consist of ponds and the wastewater impoundments for the Scotts and Goodyear facilities (characterized as excavated or diked/impounded areas [PUBGh, PUBGx, and PUBKh]).

2.1.8.2 Description of Plant and Animal Types

Natural plants occurring in the vicinity of Scotts are limited mostly to tree species. Dominant tree species occurring in the forested riparian zones along areas of Crosses Run and Mill Creek include cottonwood (*Populus deltoides*), silver maple (*Acer saccharinum*), red maple (*Acer rubrum*), sycamore (*Platanus occidentalis*), box elder (*Acer negundo*), buckeye (*Aesculus glabra*), hackberry (*Celtis occidentalis*), willow (*Salix spp.*), green ash (*Fraxinus pennsylvanica*), and American elm (*Ulmus americana*).

Records of macroinvertebrate and fish species collected from the vicinity of the Scotts Marysville facility as contained within the document "Biological and Water Quality Study of Mill Creek (Scioto River Basin) and Selected Tributaries" were reviewed. This study included sampling conducted by the Ohio EPA on the mainstream of Crosses Run and the North Branch of Crosses Run as they flow through Scotts property. The North Branch of Crosses Run is characterized as a small headwater drainage that originates in fallow pasture and agricultural fields just west of Scotts property. This branch then traverses Scotts property and drains into Crosses Run.

As recorded by Ohio EPA, both macroinvertebrate and fish species collected from Crosses Run in the vicinity of Scotts are limited to pollution tolerant species. Qualitative macroinvertebrate collections from Crosses Run upstream of Scotts property consisted primarily of backswimmers, dragonflies, and water beetles. Large numbers of lung-breathing snails (*Physella* sp.) were also collected in the area upstream of Scotts. At sampling locations downstream of Scotts, two tolerant midge taxa, *Cricotopus sylvestris* and *Polypedilum illinoense*, dominated the macroinvertebrate samples. A species of the tolerant mayfly genera *Callibaetis* was also collected in the vicinity of Scotts property.

Fish collected from both Crosses Run and the North Branch of Crosses Run were limited to tolerant species. Species collected include creek chub (*Semotilus atromaculatus*), green sunfish (*Lepomis cyanellus*), fathead minnow (*Pimephales promelas*), juvenile largemouth bass (*Micropterus salmoides*), common carp (*Cyprinus carpio*), and white sucker (*Catostomus commersoni*).

No census has been conducted for mammals, amphibians, reptiles, or birds at or near the Scotts facility; however, the old fields, drainage ditches, wetlands, and riparian corridors would provide habitat for animals tolerant of disturbed environments. These animals could include some the following common mammals: opossum (*Didelphis virginiana*), short-tailed shrew (*Blarina brevicauda*), eastern cottontail (*Sylvilagus floridanus*), eastern chipmunk (*Tamias striatus*), groundhog (*Marmota monax*), eastern gray squirrel (*Sciurus carolinensis*), prairie deer mouse (*Peromyscus maniculatus*), white-footed mouse (*Peromyscus leucopus*), meadow vole (*Microtus pennsylvanicus*), house mouse (*Mus musculus*), meadow jumping mouse (*Zapus hudsonius*), gray fox (*Urocyon cineroargenteus*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), white-tailed deer (*Odocoileus virginianus*), and muskrat (*Ondatra zibethicus*).

Resident amphibians and reptiles likely would include some of the following common species: American toad (*Bufo americanus*), bullfrog (*Rana catesbeiana*), wood frog (*Rana sylvatica*), snapping turtle (*Chelydra serpentina*), eastern box turtle (*Terrapene carolina*), painted turtle (*Chrysemys picta*), blue racer (*Columber constrictor*), rat snake (*Elaphe obsoleta*), northern water snake (*Nerodia sipedon*), queen snake (*Regina septemvittata*), brown snake (*Storeria dekayi*), and garter snake (*Thamnophis sirtalis*).

A large number of bird species could use the available habitats as nesting and foraging areas. Potential bird species are too numerous to list; however, common species include: American crow (Corvus brachyrhynchos), blue jay (Cyanocitta cristata), northern cardinal (Cardinalis cardinalis), American robin (Turdus migratorius), house sparrow (Passer domesticus), house finch (Carpodacus mexicanus), european starling (Sturnus vulgaris), turkey vulture (Cathartes aura), mourning dove (Zenaida macroura), red-winged blackbird (Agelainus phoeniceus), red-tailed hawk (Buteo jamaicensis), Carolina chickadee (Parus carolinensis), and great blue heron (Ardea herodias).

Numerous arthropod species (insects, spiders, etc.) are potentially present, including butterflies and moths (lepidoptera), beetles (coleoptera), bees, wasps, and ants (hymenoptera), and flies (diptera).

Records of federally endangered species from the United States Fish & Wildlife Service (U.S. F&WS) which have the potential to be located within the vicinity of the Scotts Marysville property include the Indiana bat (*Myotis sodalis*), the peregrine falcon (*Falco peregrinus*), the Scioto madtom (*Noturus trautmani*), the clubshell mussel (*Pleurobema clava*), and the northern riffleshell mussel (*Epioblasma tortulosa rangiana*).

Indiana bat habitat primarily consists of dead trees and snags along riparian corridors, especially trees with exfoliating bark or cavities which may be used as maternity roost areas. Woodlots adjacent to stream corridors which serve as forage sites are also important habitat requirements for this species. There is potential for areas such as these to exist in the vicinity of Scotts, primarily along Mill Creek and areas of Crosses Run.

The preferred habitat of the peregrine falcon consists of open areas, including open fields and reservoirs. Tall buildings have been chosen as nesting locations in urbanized areas.

Mill Creek is the only potential habitat located in the vicinity of Scotts for the Scioto madtom, clubshell mussel, and northern riffleshell mussel. The Scioto madtom is a rare species which is known mainly from the downstream end of sand-gravel riffles in the Scioto River drainage system. Both previously mentioned mussel species require good water quality, including low suspended solids and silt-free substrates composed of sand, gravel, and cobble.

2.2. GROUNDWATER MONITORING RESULTS

The most recent groundwater sampling event was conducted in June 1998. The June 1998 sampling represents the seventh quarterly event performed since November 1996. It was the first event where samples were collected from wells MW-41 and MW-42 that were installed in May 1998. MW-25 and MW-26 were abandoned prior to the sampling event. The groundwater samples collected were analyzed for a list of compounds that included herbicides, pesticides, semivolatile organic compounds (SVOCs) including acid compounds and base/neutral compounds, volatile organic compounds (VOCs), inorganics, and several water quality parameters. The list of parameters was developed from the list of compounds identified in sampling conducted by Ohio Environmental Protection Agency (EPA) for the December 1994 preliminary assessment. Laboratory analyses were performed by Aqua Tech Environmental Laboratories, Inc., an Ohio EPA Voluntary Action Program (VAP) certified laboratory.

On September 29, 1998, MW-34, MW-37, and MW-40 were resampled to confirm the presence of herbicides. MW-41 was resampled to confirm the presence of 2,4-D and chlordane. The previous detections of pesticides and herbicides in these four wells were all reported below laboratory detection limits during the September 1998 resample event. The groundwater analytical results are summarized in Table 2.4.

No VOCs were detected in the June 1998 groundwater samples.

Two SVOCs were detected in the June 1998 groundwater samples. At MW-40, the plasticizer bis(2-ethylhexyl)phthalate concentration (13 μ g/l) exceeded the MCL of 6 μ g/l. Bis(2-ethylhexyl)phthalate was also detected in MW-39 and MW-42 at 3.0 μ g/l and 2.5 μ g/l, respectively. Di-n-butylphthalate was detected in MW-35 at 1.5 μ g/l. No other SVOCs were detected in groundwater.

The herbicide 2,4-D was detected in MW-28 at 0.14 μ g/l, in MW-34 at 0.11 μ g/l, in MW-37 at 0.12 μ g/l, and in MW-41 at 0.28 μ g/l. All detections were below the U.S. EPA MCL of 70 μ g/l. The herbicide MCPP was detected in MW-40 at 37 μ g/l. MCPP is not currently regulated by U.S. EPA. No other herbicides were detected in groundwater. 2,4-D was reported below laboratory detection limits in MW-34, MW-37, and MW-41 during the September 1998 resample event. MCPP was reported below laboratory detection limits in MW-34, MW-37, and MW-41 during the September 1998 resample event.

In June 1998, chlordane was detected at MW-41 at 0.87 μ g/l, which is below the U.S. EPA MCL of 2.0 μ g/l. Chlordane was reported below laboratory detection limits in MW-41 during the September 1998 resample event. No other pesticides were detected in groundwater.

At MW-38, 32.0 mg/l nitrate/nitrite was detected which exceeds the MCL of 10 mg/l. Other nitrate/nitrite concentrations and inorganics concentrations detected were below MCLs. Excluding the result for MW-38, nitrate and ammonia concentrations detected have been relatively low indicating that groundwater has not been impacted by the application or disposal of lawn care products.

In general, the June 1998 results are consistent with historical results. Any detections not discussed above were within normal and typical ranges. Historically, the pesticide chlordane was detected in groundwater samples from MW-25. Two new wells, MW-41 and MW-42, were installed to replace MW-25 and MW-26. As mentioned above, a low level of chlordane (below MCL) was detected in MW-41 during the June 1998 sampling event. However, the September 1998 resample reported chlordane concentrations below laboratory detection limits.

2.3. PRIOR SITE INVESTIGATIONS

Previous site investigation work conducted at the Scotts Marysville facility includes the 1985 Resource Conservation and Recovery Act (RCRA) closure of Pond 1, two hydrogeologic investigations of the eight areas of concern, and ongoing groundwater, surface water, and stream sediment monitoring. A total of 49 groundwater monitoring wells have been installed and sampled at the Scotts property. In addition, approximately 73 stream sediment and 21 stream water samples, as well as 120 source area soil and waste samples have been collected and analyzed. The following sections briefly discuss this work.

2.3.1 Pond Site Investigation and Closure

T.A. Gleason and Associates evaluated the hydrogeologic conditions in the vicinity of Pond 1 in 1984 through 1985 in three separate reports. T.A. Gleason and Associates determined the following regarding site conditions in the vicinity of Pond 1:

- Glacial till underlying Pond 1 is primarily silty clay to Elevation 950 mean sea level (msl) (approximately 25 feet below ground surface [bgs]). Below this elevation, the glacial materials are interbedded with sand layers.
- The clay till materials between the ground surface and Elevation 950 msl have a very low permeability with few sand lenses.
- There is a downward vertical gradient in the glacial materials; however, based on the head difference between shallow and deep wells and the materials encountered, the vertical permeability is low.
- Prior to closure of Pond 1, the wells within a few hundred feet of the impoundment showed elevated nitrate levels. After the pond was closed, nitrate levels dropped to near background.

2.3.2 Ohio EPA Water Quality Monitoring and Assessment

The Ohio EPA Division of Surface Water conducted biological and water quality studies of Mill Creek and selected tributaries in 1986, 1991, and 1995 (Ohio EPA, 1987, 1991, and 1997). These studies extended from upstream of Otter Creek near East Liberty to the Mill Rd. bridge near the confluence with the Scioto River. The Scotts Company was one of several potential pollution sources in the study area. One objective of these studies was to evaluate the impact of The Scotts Company and subsidiaries as a potential source of toxics and biological degradation.

2.3.3 Ohio EPA Revised Preliminary Assessment

In December 1994, the Ohio EPA Division of Remedial Response (DERR) conducted sampling at The Scotts Company. The purpose of this sampling was facility characterization. Samples were collected from surface waters, sediments, and soils in the vicinity of the Landfill 1 through Landfill 5 and Field Broadcast Areas 1 and 2. Additionally, groundwater samples were collected from one on-site production well and on-site monitoring wells in the summer of 1995. All samples were analyzed for ammonia, nitrate and nitrite, inorganics, pesticides, herbicides, VOCs, SVOCs, and polychlorinated biphenyls (PCBs). Inorganics, VOCs, SVOCs, pesticides, and herbicides were detected in surface water, soil, and sediment samples (Ohio EPA, 1995).

2.3.4 Ohio EPA Mill Creek Geographic Initiative

To further characterize sediment and surface water at Mill Creek and selected tributaries, the Ohio EPA Division of Emergency and Remedial Response (DERR) performed additional sampling in August 1997 (Ohio EPA, 1998b). Surface water and sediment samples were taken at Crosses Run just before flowing into Mill Creek and at Crosses Run just downstream of U.S. Route 33 and Landfill 3. Duplicate surface water and sediment samples were taken at the location downstream of U.S. Route 33 and Landfill 3. Surface water samples were analyzed for pesticides, while sediment samples were analyzed for pesticides and PCBs.

2.3.5 VAP Phase 1

Burgess & Niple, Limited (B&N) completed a Phase 1 Environmental Site Assessment (ESA) in July 1997 under Ohio Environmental Protection Agency (EPA) Voluntary Action Program (VAP) protocol. The Phase 1 ESA provided a detailed review of potential environmental impacts at the Scotts Marysville facility. Based on the results of the Phase I and discussions with Ohio EPA, the primary sources of potential environmental impact were identified as the following eight areas—Landfill 1 through Landfill 5, Field Broadcast Area (FBA) 1 and 2, and Pond 2 (B&N, 1997c).

2.3.6 **B&N Hydrogeologic Investigations**

B&N has installed groundwater monitoring wells during three separate drilling events. The location of the monitoring wells installed is shown on Plate 1. The first drilling event was conducted in October 1996, and consisted of installing 14 wells around the five landfills and two field broadcast areas. Results of this drilling program were summarized in the following report previously submitted to Ohio EPA:

Hydrogeologic Investigation of Former Disposal Sites, November 1996 Groundwater Monitoring Well Installation Results, B&N, December 1996. Details on the well installation for monitoring wells MW-21 through MW-34 are presented in this report along with hydrogeologic interpretations.

Six monitoring wells were installed during a second event conducted between November 1997 and January 1998 (MW-35 through MW-40). These six additional wells were installed where additional information downgradient of the source areas was needed. Results of the well installations are documented in the following report:

Groundwater Monitoring Well Installation and Waste/Stream Sediment Characterization, B&N, April 1998.

Two additional wells were installed during a third event in May 1998 (MW-41 and MW-42). These two wells were installed to replace MW-25 and MW-26, which were determined to be completed through waste in the vicinity of Landfill 1. Results of this well installation will be documented in a report that is anticipated to be published in December 1998.

2.3.7 Quarterly Sampling Reports

Groundwater, surface water, and stream sediment sampling have been performed quarterly since November 1996 to evaluate potential environmental impacts from historic waste disposal operations at the Scotts facility. A series of reports has been prepared documenting results of the first six sampling events conducted. Each of the following reports includes discussions of the groundwater analytical results and flow direction.

Hydrogeologic Investigation of Former Disposal Sites, November 1996 Groundwater, Surface Water, and Stream Sediment Sampling Results, B&N, December 1996.

Hydrogeologic Investigation of Former Disposal Sites, February 1997 Groundwater, Surface Water, and Stream Sediment Sampling Results, B&N, March 1997.

Hydrogeologic Investigation of Former Disposal Sites, May 1997 Groundwater, Surface Water, and Stream Sediment Sampling Results, B&N, June 1997.

Hydrogeologic Investigation of Former Disposal Sites, August 1997 Groundwater, Surface Water, and Stream Sediment Sampling Results, B&N, September 1998.

Hydrogeologic Investigation of Former Disposal Sites, November 1997 Groundwater, Surface Water, and Stream Sediment Sampling Results, B&N, December 1998.

Hydrogeologic Investigation of Former Disposal Sites, February 1998 Groundwater, Surface Water, and Stream Sediment Sampling Results, B&N, March 1998.

Hydrogeologic Investigation of Former Disposal Sites, June 1998 Groundwater, Surface Water, and Stream Sediment Sampling Results, B&N, Document in Progress.

2.3.8 1997 Waste/Stream Sediment Characterization Study

A waste characterization study was begun in December 1997 and completed in January 1998 (B&N, 1998a). Soils from the eight potential areas of concern were collected and analyzed by a

VAP certified laboratory to determine the chemical characteristics of the waste associated with each area of concern. Pesticides, herbicides, and polycyclic aromatic hydrocarbons (PAHs) were detected. The soil analytical results are summarized in Table 2.5. The locations of the soil samples collected are presented in Plate 5.

To evaluate possible impacts to Crosses Run via runoff over the eight potential source areas, 22 sediment samples were collected during this investigation (Plate 6). The sediment samples were analyzed for pesticides, herbicides, and SVOCs. The analytical results for the sediment samples are summarized in Table 2.6. The locations of the sediment samples collected are presented in Plate 6.

2.3.9 Delineation of Potential Source Areas

The limits of waste at each of the eight potential source areas were determined using a combination of methods. Prior to conducting fieldwork to establish the extent of the source area, aerial photographs taken between 1957 and 1994 were studied to locate landmarks that could be used to better define the limit of waste placement. Examination of the photographs was done in conjunction with a site walk-over (B&N, 1996a).

The field delineation of waste involved examination of soil cores obtained using hydraulic direct push methods. Seventy-two direct push borings were completed during the delineation. Each core was examined for the presence of vermiculite layers (B & N, 1998c). Vermiculite is a readily distinguishable mica-like material that is the carrier for the Scotts lawn products. The southern perimeter of Landfill 2 and the eastern perimeter of Landfill 3 were delineated manually with a soil auger. The boundaries of the eight areas of concern shown on Plate 1 were drawn using a combination of the aforementioned methods.

2.3.10 1998 Stream Sediment Sampling

To confirm the results from the stream sediment sampling conducted in December 1997, an additional 34 stream sediment samples were collected (B&N, 1998d). Each of the sediment samples were analyzed for pesticides, herbicides, arsenic, mercury, and total organic carbon. Twelve samples (Sediment 2, 6, 8, 10, 11, 13, 16, 17, 18, 21, 22, and 26) were analyzed for reactive sulfide and alkalinity. Eight samples (Sediment 3, 5, 7, 12, 15, 20, 23, and Sediment duplicate-1) were analyzed for SVOCs. Twelve samples (sediment 2, 6, 8, 10, 11, 13, 16, 27, 28, 21, 22, and 26) underwent sieve analyses to describe soil grain size and provide an exact soil identification.

2.4. UNIT SPECIFIC DESCRIPTIONS

The following unit specific descriptions provide a comprehensive overview of past and present conditions at each of the investigative units.

2.4.1 Landfill 1

Landfill 1 is located west of the railroad tracks and south of the north branch of Crosses Run in the northwest portion of the Scotts property (Plate 1).

2.4.1.1 Site History

Landfill 1 was used for disposal of off-spec vermiculite waste from 1956 to 1959. In August 1998, an interim action was conducted which involved the final closure of Landfill 1. The action was associated with the installation of a railroad siding on Scotts property. The final closure design was agreed to by Ohio EPA (Ohio EPA, 1998a).

The final cover consisted of one foot of clay, a 40-mil linear low-density polyethylene (LLDPE) membrane, and one foot of vegetative cover (B&N, 1998c). Part of the landfill materials were relocated, capped, and stabilized as part of a project involving the placement of the rail spur through the landfill. For this project, sheet piling was driven through the waste materials along either side of the rail spur. Waste materials were removed from between the sheet piling and placed on top of adjacent waste materials. The area between the sheet piling was backfilled with clay. Waste materials placed outside of the sheet piling were stabilized with stone geogrid and clay. Waste materials were kept inside the footprint of the original landfill (B&N, 1998c).

2.4.1.2 Nature and Extent of Potential Contamination

Waste Delineation

Five soil borings (B-5 to B-9) were completed on June 12, 1998 using direct push technology to determine the limits of waste at landfill 1 (B&N, 1998c). The lateral limits were generally confined to the area between Pond 3 and Above Ground Storage Tanks 5 and 5A. The borings confirmed the known boundary of Landfill 1 (Figure 2.3).

Soils

It should be noted that the soils discussed here have been covered with a cap as discussed above. The concentrations of chemical constituents discussed here have therefore been isolated by one foot of clay, a 40-mil linear low-density polyethylene (LLDPE) membrane, and one foot of vegetative cover.

Four soil samples were collected by Burgess & Niple at Landfill 1 (Figure 2.3) (B&N, 1998a). Soil 6 and Soil 7 were collected from the depth interval of 0 to 4 inches. Soil 8 was collected from the 3 to 5 inch depth interval. Soil 9 was collected from the 18 to 24 inch depth interval. Sampling focused on exposed waste material along the drainage ditch adjacent to Pond 3, where erosion of the existing cover and groundhog activity had exposed waste vermiculite in the ditch. The soil samples were analyzed for pesticides, herbicides, and SVOCs. The soil analytical results are summarized in Table 2.5.

Chlordane and 4,4'-DDT were detected in all four soil samples. Chlordane was detected at concentrations ranging from 7,200 (Soil 6) to 82,000 μ g/kg (Soil 8). 4,4'-DDT was detected at concentrations ranging from 910 (Soil 6) to 8,800 μ g/kg (Soil 8). The herbicide silvex was detected in Soil 6 at a concentration of 80 μ g/kg. SVOCs were detected in Soil 6 and 7 at concentrations ranging from 520 μ g/kg (fluoranthene, Soil 6) to 1,500 μ g/kg (pyrene, Soil 7 and naphthalene, Soil 6).

During Ohio EPA sampling (Ohio EPA, 1995), one soil sample (OMS-SO-11) was collected for analysis of SVOCs, pesticides, herbicides, ammonia, nitrate/nitrite, and inorganics. The soil analytical results for the Ohio EPA sampling are summarized in Table 2.5. Nitrate/nitrite,

benzo(a)pyrene, and chlordane were detected in OMS-SO-11 at concentrations of 336.0 mg/kg, 110.0J μ g/kg, and 4,200.0 μ g/kg, respectively. Mercury was also detected at a concentration of 0.13 mg/kg. The depth the soil sample was collected from is not recorded.

Sediment

Sample Sediment 1 from B&N's December 1997 investigation was located adjacent to Landfill 1 and was analyzed for pesticides, herbicides, and SVOCs (Figure 2.3) (B&N, 1998b). The sediment analytical results are summarized in Table 2.6. The pesticides chlordane and 4,4'-DDT were detected at concentrations of 2,500 μ g/kg and 340 μ g/kg, respectively. The herbicide 2,4-D was detected at a concentration of 150 μ g/kg. SVOCs were detected in this sediment sample at concentrations ranging from 900 μ g/kg (benzo(a)anthracene) to 2,100 μ g/kg (pyrene).

Groundwater

Groundwater quality at Landfill 1 were assessed by three monitoring wells installed in October 1996: MW-25, MW-26, and MW-27 (B&N, 1996a). The groundwater elevations indicated a flow direction to the southeast. Based on this flow direction, MW-25 and MW-26 are downgradient of Landfill 1 and MW-27 is upgradient of Landfill 1 (Figure 2.3). In May 1998, groundwater monitoring wells MW-41 and MW-42 were installed to replace MW-25 and MW-26 which were inside landfill limits and had been drilled through a few feet of waste (B&N, 1998b). A series of seven sampling events were conducted on a quarterly basis between November 1996 and June 1998. Groundwater samples were analyzed for VOCs, SVOCs, pesticides, herbicides, inorganics, and several water quality parameters. The groundwater analytical results are summarized in Table 2.4.

The only inorganic constituents detected at Landfill 1 above the MCL for drinking water were nickel (110 μ g/l at MW-25, November 1996 and 150 μ g/l at MW-27, November 1996 and ammonia between 1.34 and 2.2 mg/L in MW-25). The MCL for nickel is 100 μ g/l. The only pesticide detected at Landfill 1 was chlordane at concentrations ranging from 0.18 μ g/l (MW-25, February 1998) to 2.1 μ g/l (MW-25, August 1997). Chlordane was detected once above its MCL of 2.0 μ g/l. The only herbicide detected at Landfill 1 was 2,4-dichlorophenoxyacetic acid at a concentration of 0.28 μ g/l (MW-41, June 1998). 2,4-dichlorophenoxyacetic acid was not detected above its MCL.

SVOCs detected at Landfill 1 were bis(2-ethylhexyl)phthalate, diethylphthalate, and di-n-butylphthalate. Bis(2-ethylhexyl)phthalate was detected at concentrations ranging from 1.3 $\mu g/l$ (MW-25, February 1998, below laboratory EQL) to 8.2 $\mu g/l$ (MW-27, May 1997). Diethylphthalate was detected at a concentration of 0.28 $\mu g/l$ (MW-26, August 1997, below laboratory EQL). Di-n-butylphthalate was detected at concentrations of 2.7 $\mu g/l$ (MW-27, August 1997, below laboratory EQL) and 1.0 $\mu g/l$ (MW-26, August 1997, below laboratory EQL).

VOCs detected at Landfill 1 were acetone, chloroform, methylene chloride, and toluene. Acetone and chloroform were detected at concentrations of 1.46 and 0.634 μ g/l (MW-26, August 1997, below laboratory EQL), respectively. Methylene chloride was detected at concentrations ranging from 2.5 μ g/l (MW-26, May 1997) to 2.9 μ g/l (MW-27, May 1997). Methylene chloride was also detected in the trip blank during the May 1997 sampling event, thus potentially indicating that the May 1997 detections may have been due to laboratory interference. Toluene was detected at a concentration of 0.420 μ g/l (MW-25, August 1997, below laboratory EQL).

2.4.1.3 Interim Measures

In March 1997, silt fencing was installed around Landfill 1 to reduce exposure of waste material to stormwater runoff (Figure 2.3). In addition, the soil cover was redistributed to cover exposed waste brought up by burrowing animals. Areas of heavy vegetation were cleared and a mowing schedule established in order to reduce burrowing activity (B&N, 1998b). As discussed in Section 4.2.1.1, the landfill was closed in August 1998.

2.4.2 Landfill 2

Landfill 2 is located in the east-southeast corner of the Scotts property, southwest of Industrial Parkway and southeast of Scottslawn Road. Crosses Run is located along the east and south boundaries of the landfill (Plate 1).

2.4.2.1 Site History

Landfill 2 was used for disposal of off-spec vermiculite waste from 1959 to 1961. Landfill 2 is currently covered by one foot or less of clay soil. Rodent activity around the landfill has locally exposed waste (B&N, 1998b).

2.4.2.2 Nature and Extent of Potential Contamination

Waste Delineation

Twenty soil borings (B-10 to B-29) were completed on June 12 and 15, 1998 using direct push technology to determine the limits of waste at Landfill 2 (B&N, 1998c). The borings were taken on the north, south and west sides of the landfill. They confirmed the known boundary of Landfill 2 (Figure 2.4).

Soils

B&N collected four soil samples (Soil 29A, Soil 30, Soil 31, and Soil 32) from the 0 to 3 inch depth interval (B&N, 1998a). Soil 29B was collected from the 24 to 30 inches depth interval. Sampling focused on areas of thin cover and/or exposed vermiculite waste. Soil 29B was collected from the waste material within the landfill. The soil samples were analyzed for SVOCs, pesticides, and herbicides. The soil analytical results are summarized in Table 2.5.

Chlordane was detected in four of the five soil samples at concentrations ranging from 1,300 (Soil 32) to 13,000 μ g/kg (Soil 31). 4,4'-DDD and 4,4'-DDT were detected in three of the five samples. 4,4'-DDD was detected in concentrations ranging from 1,300 (Soil 29B) to 2,400 μ g/kg (Soil 31). 4,4'-DDT was detected in concentrations ranging from 5,700 (Soil 29B) to 8,700 μ g/kg (Soil 31). No herbicides were detected. SVOCs were detected in Soils 29A and 32 at concentrations ranging from 630 μ g/kg (fluoranthene, Soil 32) to 1,000 μ g/kg (di-n-butylphthalate, Soil 29A).

One soil sample was collected by Ohio EPA (OMS-SO-04) for analysis of SVOCs, pesticides, herbicides, ammonia, nitrate/nitrite, and inorganics (Ohio EPA, 1995). The soil analytical results are summarized in Table 2.5. Manganese was detected in OMS-SO-04 at a concentration of 737.0

mg/kg and mercury at a concentration of 0.08 mg/kg. The depth the soil sample was collected from is not recorded.

Sediment

Sample Sediment 12 from B&N's December 1997 investigation is located adjacent to Landfill 2 (Figure 2.4). Sediment 12 was analyzed for pesticides, herbicides, inorganics, and SVOCs (B&N, 1998b). The sediment analytical results are summarized in Table 2.6.

In sample Sediment 12, the pesticide chlordane was detected at a concentration of $160 \,\mu\text{g/kg}$. SVOCs were also detected in sample Sediment 12 at concentrations ranging from 910 $\mu\text{g/kg}$ (anthracene) to 5,900 $\mu\text{g/kg}$ (fluoranthene). No herbicides were detected.

Sample Sediment 5 from B&N's September 1998 investigation was located adjacent to Landfill 2 and was analyzed for pesticides, herbicides, SVOCs, arsenic, mercury, and total organic carbon (Figure 2.4) (B&N, 1998d). The sediment analytical results are summarized in Table 2.6. The pesticide chlordane was detected at a concentration of 19 mg/kg. SVOCs were detected in this sediment sample at concentrations ranging from 6,477 μ g/kg (dibenzofuran) to 62,124 μ g/kg (fluoranthene). Arsenic and mercury were detected in Sediment 5 at concentrations of 12 mg/kg and 0.027 mg/kg, respectively. Herbicides were not detected in sample Sediment 5.

Groundwater

Groundwater samples collected from MW-22, MW-23, and MW-24 indicate a flow direction to the southeast. Based on this flow direction, MW-22 and MW-23 are downgradient and MW-24 is upgradient of Landfill 2 (Figure 2.4) (B&N, 1996a). A series of seven sampling events were conducted on a quarterly basis between November 1996 and June 1998. The groundwater samples were analyzed for VOCs, SVOCs, pesticides, herbicides, inorganics, and several water quality parameters. The groundwater analytical results are summarized in Table 2.4.

Inorganics detected at Landfill 2 above MCLs were antimony and nickel at concentrations of 6.2 and 120 μ g/l (MW-23, November 1996), respectively. The MCLs for antimony and nickel are 6.0 and 100 μ g/l, respectively. Pesticides detected at Landfill 2 were chlordane and gamma BHC (Lindane) at concentrations of 0.0730 μ g/l (MW-22, August 1997, below laboratory EQL) and 0.021 μ g/l (MW-23, May 1997, below laboratory EQL), respectively. No herbicides were detected at Landfill 2.

SVOCs detected at Landfill 2 were bis(2-ethylhexyl)phthalate and di-n-butylphthalate. Bis(2-ethylhexyl)phthalate was detected at concentrations ranging from $1.2 \mu g/l$ (MW-24, August 1997, below laboratory EQL) to 5.2 $\mu g/l$ (MW-22, August 1997, below laboratory EQL). Di-n-butylphthalate was detected at a concentration of 0.42 $\mu g/l$ (MW-24, August 1997, below laboratory EQL).

VOCs detected at MW-22 were acetone and methylene chloride. Acetone was detected at concentrations ranging from 1.40 μ g/l (MW-23, August 1997, below laboratory EQL) to 1.74 μ g/l (MW-24, August 1997, below laboratory EQL). Methylene chloride was detected at concentrations ranging from 0.470 μ g/l (MW-22, August 1997, below laboratory EQL) to 4.2 μ g/l (MW-23, May 1997). Methylene chloride was also detected in the trip blank during the May

1997 sampling event, thus potentially indicating that the May 1997 detections may have been due to laboratory interference.

2.4.2.3 Interim Measures

In March 1997, silt fencing was installed around Landfill 2 to reduce exposure of waste material to stormwater runoff (Figure 2.4) (B&N, 1998b). Additional silt fencing was installed in May 1998 along the south and east sides of the landfill to prevent runoff of landfill materials into Crosses Run. The area between the landfill and Crosses Run, however, contains a 3 to 6 inch thick veneer of identifiable waste in the upper one foot of soil (B&N, 1998c).

2.4.3 Landfill 3

Landfill 3 is located in the northeast corner of the Scotts property, southeast of Scottslawn Road and under U.S. Route 33 (Plate 1). The most significant portion of the landfill is present northeast of U.S. Route 33, which is currently covered by one foot or less of clay soil. A small portion of the landfill lies across U.S. Route 33 to the southeast. Rodent activity around the landfill has locally exposed waste (B&N, 1998b).

Only the northern portion of Landfill 3 is currently owned by Scotts, with the southern portion of the landfill owned by The Ohio Department of Transportation (ODOT) and under their consideration for remedial activities.

2.4.3.1 Site History

Landfill 3 was used for disposal of off-spec vermiculite waste from 1962 to 1964. The landfill was disturbed by the ODOT when U.S. Route 33 was built in the late 1960s. The drainage ditch on the north side of U.S. Route 33 cuts through the landfill and has exposed the vermiculite. This drainage ditch has allowed waste materials from Landfill 3 to run off into Crosses Run to the northwest (B&N, 1998c).

2.4.3.2 Nature and Extent of Potential Contamination

Waste Delineation

No new borings were taken at Landfill 3 during the June 1998 study by Burgess & Niple (B&N, 1998c). Previous delineation had been conducted from old aerial photographs and installation of monitoring wells. Further delineation work was completed by Dodson-Stilson, Inc. (DSI) on behalf of ODOT in August 1998 along U.S. Route 33 in the vicinity of Landfill 3. The study further defined the lateral extent of waste at Landfill 3 (Figure 2.5).

Soils

One soil sample (Soil 36A) was collected by B&N from the 0 to 3 inch depth interval (B&N 1998a). Four soil samples (Soil 33, Soil 34, Soil 35, and Soil 35 duplicate) were collected from the 0 to 5 inch depth interval. One soil sample (Soil 36B) was collected from the 24 to 30 inch depth interval (Figure 2.5). Soil samples Soil 36A and Soil 36B were collected from the portion of the landfill on the Scotts property. Soil samples Soil 33, Soil 34, Soil 35, and Soil 35, and Soil 35 duplicate were collected from exposed waste materials along the U.S. Route 33 highway embankment,

which is a part of the ODOT property. The soil samples were analyzed for SVOCs, pesticides, and herbicides. The soil analytical results are summarized in Table 2.5.

Soil samples 36A and 36B contained 4,4'-DDT at concentrations of 230 and 140 μ g/kg, respectively. The herbicide 2,4-D was detected at a concentration of 40 μ g/kg in 36B.

In the soil samples collected from exposed waste materials along the U.S. Route 33 highway embankment, chlordane was detected in three of the four samples at concentrations ranging from 47,000 (Soil 33) to 77,000 μ g/kg (Soil 35 duplicate). 4,4'-DDD was detected in three of the four samples at concentrations ranging from 1,400 (Soil 35 duplicate) to 10,000 μ g/kg (Soil 33). 4,4'-DDT was detected in all four samples at concentrations ranging from 120 (Soil 34) to 13,000 μ g/kg (Soil 33). The herbicide dicamba was detected at a concentration of 110 μ g/kg (Soil 33). The only SVOC detected was fluoranthene at a concentration of 680 μ g/kg (Soil 33).

One soil sample (OMS-SO-02) was collected by Ohio EPA for analysis of SVOCs, pesticides, and herbicides, ammonia, nitrate/nitrite, and inorganics (Ohio EPA, 1995). The soil analytical results are summarized in Table 2.5. Ammonia and nitrate/nitrite were detected in OMS-SO-02 at concentrations of 990.0 mg/kg and 123.0 mg/kg, respectively. SVOCs were detected in concentrations ranging from 390.0 μ g/kg (dibenz(a,h)anthracene) to 1,200.0 μ g/kg (benzo(b)fluoranthene. The pesticides heptachlor, 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT were detected at concentrations of 3,500.0J, 4,400.0J, 24,000.0J, and 100,000.0 μ g/kg, respectively. Mercury was detected at a concentration of 4.48 mg/kg. The depth the soil sample was collected from is not recorded.

Sediments

During the December 1994 Ohio EPA sampling, one sediment sample (OMS-SD-03) was analyzed for SVOCs, inorganics, pesticides, and herbicides. The sediment analytical results are summarized in Table 2.6. Manganese, benzo(a)pyrene, and chlordane were detected at concentrations of 420.0 mg/kg, 390.0 μ g/kg, and 7,100.0 μ g/kg, respectively in OMS-SD-03.

Sample Sediment 18 from B&N's December 1997 investigation is located adjacent to Landfill 3 (Figure 2.5). Sediment 18 was analyzed for pesticides, herbicides, and SVOCs (B&N, 1998b). The sediment analytical results are summarized in Table 2.6. Sample Sediment 18 contained the pesticides chlordane 4,4'-DDD, and 4,4'-DDT at concentrations of 580 μ g/kg, 230 μ g/kg, and 340 μ g/kg, respectively. No herbicides or SVOCs were detected.

Samples Sediment 24a through Sediment 24d from B&N's September 1998 investigation were located adjacent to Landfill 3 and were analyzed for pesticides and herbicides (Figure 2.5) (B&N, 1998d). The sediment samples were collected in line across the width of the stream with Sediment 24a along the east bank and Sediment 24d along the west bank. The sediment analytical results are summarized in Table 2.6. The pesticide chlordane was detected in all four samples at concentrations ranging from 2.1 mg/kg (Sediment d) to 25 mg/kg (Sediment 24a). Herbicides were not detected in samples Sediment 24a through Sediment 24d.

Surface Water

During the December 1994 Ohio EPA sampling, one surface water sample (OMS-SW-01) was analyzed for SVOCs, pesticides, herbicides, and inorganics (Ohio EPA, 1995). The surface water

analytical results are summarized in Table 2.7. The VOCs 2-butanone and toluene were detected at concentrations of 13.0 μ g/kg and 6.1 μ g/kg, respectively in OMS-SW-01. The pesticides heptachlor epoxide, endrin, and endosulfan II were detected at concentrations of 0.07 μ g/kg, 0.10 μ g/kg, and 0.26 μ g/kg, respectively. The herbicide 2,4-D was detected at a concentration of 62.0 μ g/kg.

Groundwater

Groundwater elevations taken from monitoring wells MW-32, MW-33, and MW-34 indicate a flow direction to the southeast. Based on this flow direction, MW-32 is cross-gradient, MW-33 is downgradient, and MW-34 is cross-gradient of Landfill 3 (Figure 2.5) (B&N, 1996a). Between December 1997 and January 1998, groundwater monitoring well MW-37 was installed downgradient of Landfill 3 (B&N, 1998b). A series of seven sampling events have been conducted on a quarterly basis in these wells between November 1996 and June 1998. The groundwater samples were analyzed for VOCs, SVOCs, pesticides, herbicides, inorganics, and several water quality parameters. The groundwater analytical results are summarized in Table 2.4.

The only inorganic constituents detected at Landfill 3 above an MCL were antimony at a concentration of 6.8 μ g/l (MW-34, February 1997, MCL = 6.0 μ g/l) and mercury at a concentration of 2.2 μ g/l (MW-34, November 1997, MCL = 2 μ G/l). Mercury was below detection limits in each of the other six sampling events. No pesticides have been detected at Landfill 3. The only herbicide detected was 2,4-dichlorophenoxyacetic acid at concentrations of 0.11 μ g/l (MW-34, June 1998) and 0.12 μ g/l (MW-37, June 1998).

SVOCs detected at Landfill 3 included bis(2-ethylhexyl)phthalate and di-n-butylphthalate. Bis(2-ethylhexyl)phthalate was detected at concentrations ranging from 0.76 μ g/l (MW-32, August 1997, below laboratory EQL) to 32 μ g/l (MW-33, August 1997). Di-n-butylphthalate was detected once at a concentration of 0.287 μ g/l (MW-33, August 1997, below laboratory EQL).

VOCs detected at MW-32 included acetone and methylene chloride. Acetone was detected at a concentration of 1.75 μ g/l (MW-32, August 1997, below laboratory EQL). Methylene chloride was detected at concentrations ranging from 0.884 μ g/l (MW-33, August 1998, below laboratory EQL) to 9.7 μ g/l (MW-32, May 1997). Methylene chloride was also detected in the trip blank during the May 1997 sampling event, potentially indicating that the May 1997 detections may be due to laboratory interference.

2.4.3.3 Interim Measures

In March 1997, silt fencing was installed around Landfill 3 to reduce exposure of waste material to stormwater runoff (Figure 2.5). This silt fencing was limited to the area on Scotts property. There is a sizable area of exposed waste on adjacent ODOT property next to the highway ditch. In addition, the soil cover has been redistributed to cover exposed waste brought up by burrowing animals. Areas of heavy vegetation were cleared and a mowing schedule established in order to reduce burrowing activity (B&N, 1998b). Additional silt fencing was installed in May 1998 between Landfill 3 and the drainage ditch and Crosses Run to prevent runoff of landfill materials into the surface water (Figure 2.5). ODOT is currently in the process of conducting closure of the section of Landfill 3 that is located on state property (B&N, 1998c).

2.4.4 Landfill 4

Landfill 4 is adjacent to Landfill 5 on the south-southeast corner of the Scotts property. Crosses Run flows along the north side of the landfill. An unnamed tributary stream to Crosses Run flows along the east side of the landfill (Plate 1).

2.4.4.1 Site History

Landfill 4 was used for disposal of off-spec vermiculite waste from 1965 to 1976. Field observations have indicated that construction debris and brush are also present. Landfill 4 is currently covered by one foot or less of clay soil. Rodent activity around the landfill has locally exposed waste (B&N, 1998b).

2.4.4.2 Nature and Extent of Potential Contamination

Waste Delineation

Fifteen soil borings (B-30 to B-44) were completed on June 16, 1998 using direct push technology to determine the limits of waste at Landfill 4 (B&N, 1998c). Waste was encountered solely at B-35, B-39, B-40, and B-41. This confirmed the known boundary of Landfill 4 (Figure 2.6).

Soil

Three soil samples (Soil 26, Soil 27, and Soil 28A) were collected from the 0 to 3 inch depth interval. One soil sample (Soil 28B) was collected from the 24 to 30 inch depth interval (B&N, 1998a) (Figure 2.6). The soil samples were analyzed for SVOCs, pesticides, and herbicides. The soil analytical results are summarized in Table 2.5. Chlordane and 4,4'-DDT were detected in one of the four soil samples at concentrations of 280 μ g/kg (Soil 27) and 120 μ g/kg (Soil 26), respectively. No herbicides were detected. SVOCs were detected in concentrations ranging from 530 μ g/kg (phenanthrene, Soil 28B) to 87,000 μ g/kg (fluoranthene, Soil 26).

During the December 1994 Ohio EPA sampling (Ohio EPA, 1995), two soil samples (OMS-SO-09 and OMS-SO-10) were collected for analysis of SVOCs, pesticides, herbicides, ammonia, nitrate/nitrite, and inorganics. The soil analytical results are summarized in Table 2.5. Nitrate/nitrite was detected at a concentration of 103.0 mg/kg (OMS-SO-10). SVOCs were detected at concentrations ranging from 5,800.0 μ g/kg (OSM-SO-10) to 120,000.0 μ g/kg (OSM-SO-10). Manganese was detected at concentrations of 407.0 mg/kg (OMS-SO-09) and 390.0 mg/kg (OMS-SO-10) and mercury at concentrations of 0.18 mg/kg (OMS-SO-09) and 0.25 mg/kg (OMS-SO-10). The depths the soil samples were collected from are not recorded.

Sediment

Sample Sediment 7 from B&N's December 1997 investigation was collected adjacent to Landfill 4 (Figure 2.6) (B&N, 1998b). Sediment 7 was analyzed for pesticides, herbicides, and SVOCs. The sediment analytical results are summarized in Table 2.6. No pesticides or herbicides were detected. SVOCs were detected at concentrations ranging from 53,000 μ g/kg (dibenzofuran) to 560,000 μ g/kg (fluoranthene).

Sample Sediment 20 from B&N's September 1998 investigation was located adjacent to Landfill 4 and was analyzed for pesticides, herbicides, SVOCs, arsenic, mercury, and total organic carbon (Figure 2.6) (B&N, 1998d). The pesticide chlordane was detected at a concentration of 6.6 mg/kg. Arsenic and mercury were detected in Sediment 20 at concentrations of 15 mg/kg and 0.48 mg/kg, respectively. Herbicides and SVOCs were not detected in sample Sediment 20.

Groundwater

Groundwater elevations measured from the monitoring wells MW-28 and MW-29 indicate a flow direction to the southeast (Figure 2.4.4.1). Based on this flow direction, MW-28 is cross-gradient, and MW-29 is screened in the localized saturated zone of Landfill 4 (Figure 2.6) (B&N, 1996a). Between December 1997 and January 1998, groundwater monitoring well MW-36 was installed downgradient of Landfill 4 (B&N, 1998b). A series of seven sampling events have been conducted on a quarterly basis between November 1996 and June 1998. The groundwater samples were analyzed for VOCs, SVOCs, pesticides, herbicides, inorganics, and several water quality parameters. The groundwater analytical results are summarized in Table 2.4.

The inorganics detected at Landfill 4 above MCLs were antimony and nickel at concentrations of 6.1 μ g/l (MW-29, November 1996), and 100 μ g/l (MW-29, February 1997), respectively. The MCLs for antimony and nickel are 6.0 and 100 μ g/l, respectively.

No pesticides were detected at Landfill 4. The only herbicide detected was 2,4-dichlorophenoxyacetic acid at a concentration of $0.14 \mu g/l$ (MW-28, June 1998).

SVOCs detected at Landfill 4 were bis(2-ethylhexyl)phthalate, butylbenzyphthalate, diethylphthalate, and di-n-butylphthalate. Bis(2-ethylhexyl)phthalate was detected at concentrations ranging from 0.75 μ g/l (MW-30, August 1997, below laboratory EQL) to 4.4 μ g/l (MW-29, February 1998). Butylbenzylphthalate was detected at a concentration of 0.044 μ g/l (MW-30, August 1997, below laboratory EQL). Diethylphthalate was detected at a concentration of 0.15 μ g/l (MW-28, August 1997, below laboratory EQL). Di-n-butylphthalate was detected at concentration of 1.2 μ g/l (MW-28, August 1997, below laboratory EQL). Di-n-butylphthalate was detected at concentrations of 1.2 μ g/l (MW-28, August 1997, below laboratory EQL).

VOCs detected at Landfill 4 were acetone, methylene chloride, and toluene. Acetone was detected at concentrations of 1.46 μ g/l (MW-28, August 1997, below laboratory EQL) and 1.77 μ g/l (MW-30, August 1997, below laboratory EQL). Methylene chloride was detected at concentrations ranging from 0.557 μ g/l (MW-30, August 1997, below laboratory EQL) to 1.7 μ g/l (MW-29, May 1997). Methylene chloride was also detected in the trip blank during the May 1997 sampling event, thus potentially indicating that May 1997 detections may be due to laboratory interference. Toluene was detected at concentrations of 0.9 μ g/l (MW-28, May 1997, below laboratory EQL) and 0.410 μ g/l (MW-28, August 1997, below laboratory EQL).

2.4.4.3 Interim Measures

In March 1997, silt fencing was installed around Landfill 4 to reduce exposure of waste material to stormwater runoff (Figure 2.6) (B&N, 1998b). Additional silt fencing was installed in May 1998 between the landfill and Crosses Run to prevent runoff of landfill materials into Crosses Run (B&N, 1998c).

2.4.5 Landfill 5

Landfill 5 is adjacent to Landfill 4 on the south-southeast corner of the Scotts property. Crosses Run flows along the north side of the landfill. An unnamed tributary stream to Crosses Run flow along the west side of the landfill (Plate 1).

2.4.5.1 Site History

Landfill 5 was used for disposal of off-spec vermiculite waste from 1976 to 1984. Field observations have indicated that construction debris and brush are also present. Landfill 5 is currently covered by one foot or less of clay soil. Rodent activity around the landfill has locally exposed waste (B&N, 1998b).

2.4.5.2 Nature and Extent of Potential Contamination

Waste Delineation

Sixteen soil borings (B-45 to B-60) were completed on June 16, 1998 using direct push technology to determine the limits of waste at Landfill 5 (B&N, 1998c). Only a trace of vermiculite was encountered at Landfill 5. The borings confirmed the known boundary of Landfill 5 (Figure 2.6).

Soils

Two soil samples (Soil 24 and Soil 25) were collected from the 0 to 3 inch depth interval, and two soil samples (Soil 22 and Soil 23A) were collected from the 0 to 5 inch depth interval. One soil sample (Soil 23B) was collected from the 24 to 30 inches depth interval (B&N, 1998a) (Figure 2.6). Samples 22 and 25 were collected in the drainage ditches on either side of the landfill. Samples 23A, 23B, and 24 were collected from the top of the landfill. The soil samples were analyzed for SVOCs, pesticides, and herbicides. The soil analytical results are summarized in Table 2.5.

Chlordane was detected in two of the five soil samples at concentrations of $520 \,\mu$ g/kg (Soil 23A) and 240 μ g/kg (Soil 24). No herbicides were detected. The only SVOC detected was fluoranthene at a concentration of 880 μ g/kg (Soil 23A).

During the December 1994 Ohio EPA sampling (Ohio EPA, 1995), two soil samples (OMS-SO-19 and OMS-SO-20) were collected for analysis of SVOCs, pesticides, herbicides, ammonia, nitrate/nitrite, and inorganics. The soil analytical results are summarized in Table 2.5. Heptachlor was detected at a concentration of 1,000.0 μ g/kg (OSM-SO-19). Adrian was detected at concentrations of 310.0 μ g/kg (OSM-SO-19) and 47.0 μ g/kg (OSM-SO-20). Chlordane was detected at concentrations of 32,000.0 μ g/kg (OSM-SO-19) and 3,500.0 μ g/kg(OSM-SO-20). The SVOC benzo(a)pyrene was detected at a concentration of 230.0J μ g/kg (OSM-SO-20). Mercury was detected at concentrations of 1.63 mg/kg (OMS-SO-19) and 0.25 mg/kg (OMS-SO-20). The depths the soil samples were collected from is not recorded.

Sediment

No sediment samples have been collected adjacent to Landfill 5 (B&N, 1998b and 1998d).

Groundwater

Groundwater elevations measured in the three monitoring wells MW-28, MW-30, and MW-31 indicate a flow direction to the southeast. Based on this flow direction, MW-28 is upgradient, MW-30 is downgradient, and MW-31 is cross-gradient of Landfill 5 (Figure 2.6) (B&N, 1996a). Between December 1997 and January 1998, groundwater monitoring well MW-35 was installed downgradient of Landfill 5 (B&N, 1998b). A series of seven sampling events were conducted on a quarterly basis between November 1996 and June 1998. The groundwater samples were analyzed for VOCs, SVOCs, pesticides, herbicides, inorganics, and several water quality parameters. The groundwater analytical results are summarized in Table 2.4.

No inorganics were detected above the MCLs at Landfill 5. No pesticides were detected at Landfill 5. The only herbicide detected was 2,4-dichlorophenoxyacetic acid at a concentration of $0.14 \mu g/l$ (MW-28, June 1998).

SVOCs detected at Landfill 5 were benzo(g,h,i)perylene, bis(2-ethylhexyl)phthalate, butylbenzyphthalate, diethylphthalate, and di-n-butylphthalate. Benzo(g,h,i)perylene was detected at a concentration of 0.12 μ g/l (MW-31, August 1997, below laboratory EQL). Bis(2-ethylhexyl)phthalate was detected at concentrations ranging from 0.51 μ g/l (MW-31, August 1997, below laboratory EQL) to 3.8 μ g/l (MW-31, February 1998). Butylbenzylphthalate was detected at a concentration of 0.14 μ g/l (MW-30, August 1997, below laboratory EQL). Diethylphthalate was detected at a concentration of 0.15 μ g/l (MW-28, August 1997, below laboratory EQL). Diethylphthalate was detected at a concentration of 0.15 μ g/l (MW-28, August 1997, below laboratory EQL). Di-n-butylphthalate was detected at concentrations ranging from 0.35 μ g/l (MW-31, August 1997, below laboratory EQL to 1.5 μ g/l (MW-35, June 1998).

VOCs detected at Landfill 5 were acetone, methylene chloride, and toluene. Acetone was detected at concentrations of 1.46 μ g/l (MW-28, August 1997, below laboratory EQL) and 1.77 μ g/l (MW-30, August 1997, below laboratory EQL). Methylene chloride was detected at concentrations ranging from 0.501 μ g/l (MW-31, August 1997, below laboratory EQL) to 1.2 μ g/l (MW-31, May 1997). Methylene chloride was also detected in the trip blank during the May 1997 sampling event, thus potentially indicating that the May 1997 detections may have been due to laboratory interference. Toluene was detected at concentrations of 0.9 μ g/l (MW-28, May 1997, below laboratory EQL) and 0.410 μ g/l (MW-28, August 1997, below laboratory EQL).

2.4.5.3 Interim Measures

In March 1997, silt fencing was installed around Landfill 5 to reduce exposure of waste material to stormwater runoff (Figure 2.6)(B&N, 1998b). Additional silt fencing was installed in May 1998 between the landfill and Crosses Run to prevent runoff of landfill materials into Crosses Run (B&N, 1998c).

2.4.6 Field Broadcast Area 1

Field Broadcast Area (FBA) 1 is located in the southern portion of the facility (Plate 1). The limits of FBA 1 are defined by the Conrail rail line to the east, Scottslawn Road to the north, south branch of Crosses Run to the south, and the access road to Landfill 4 and Landfill 5 to the west (Figure 2.7) (B&N, 1997a). The limits of waste for FBA 1 were determined based on aerial

photographs, site inspections, recollections of Scotts employees, and physical boundaries (B&N, 1998c).

2.4.6.1 Site History

FBA 1 was used for the spreading of off-specification (off-spec) fertilizers and other lawn care products from 1972 to 1973. Much of the waste deposited in the field broadcast area was off-spec waste in a vermiculite carrier matrix. It is unknown what quantities or concentrations of pesticides or herbicides were contained in the vermiculite waste (B&N, 1996a). FBA 1 is currently covered in grass and periodically mowed by The Scotts Company (B&N, 1997a).

2.4.6.2 Nature and Extent of Potential Contamination

DERR collected samples from surface waters, sediments, and soils in the vicinity of the landfills and the broadcast areas in 1994. Additionally, groundwater samples were collected from the one on-site production well and on-site monitoring wells in the summer of 1995. All samples were analyzed for ammonia, nitrate/nitrite, inorganics, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, herbicides, and polychlorinated biphenyls (PCBs).

Soils

Ohio EPA collected two soil samples (OMS-SO-07 and OMS-SO-08) from FBA 1 (Figure 2.7). Soil sample OMS-SO-08 was collected from the shallow soils and soil sample OMS-SO-07 was collected from the deeper soils. The exact depths the soil samples were collected from is not recorded. The soil samples were analyzed for SVOCs, pesticides, herbicides, ammonia, nitrate/nitrite, and inorganics. The soil analytical results are summarized in Table 2.5. Chlordane, heptachlor, nitrate/nitrite, and mercury were detected in OMS-SO-08 at concentrations of 4,400.0 μ g/kg, 180.0 μ g/kg, 937.0 mg/kg and 0.14 mg/kg, respectively. Chlordane, nitrate/nitrite, and mercury were detected in OMS-SO-08 at concentrations of 2,900.0 μ g/kg, 318.0 mg/kg and 0.3 mg/kg, respectively.

During December 1997 sampling conducted by Burgess & Niple (B&N, 1998b), nine soil samples were collected from FBA 1 for analysis of pesticides, herbicides, and SVOCs. Seven soil samples (Soil 16, Soil 17A, Soil 18, Soil 19, Soil 20A, Soil 21, and Soil 21 duplicate) were collected from a depth interval of 0 to 3 inches. One soil sample (Soil 17B) was collected from a depth interval of 18 to 24 inches and another (Soil 20B) was collected from a depth interval of 24 to 30 inches. The location of the soil samples were biased towards areas where visual evidence of vermiculite existed (Figure 2.7). The soil analytical results are summarized in Table 2.5. Chlordane was detected in six of seven soil samples from the 0 to 3 inch depth interval at concentrations ranging from 1,600 µg/kg (Soil 21) to 8,600 µg/kg (Soil 17A). The pesticide, 4,4'-DDT was detected in Soil 20A at a concentration of 340 µg/kg. Herbicides and SVOCs were not detected in the soil samples collected at FBA 1. Soil samples, Soil 17B and Soil 20B, did not contain any pesticides, herbicides, or SVOCs (B&N, 1998b). Three additional soil samples (Soil 38, Soil 39, and Soil 40) (B&N, 1998f) were collected by Burgess & Niple and analyzed for herbicides and pesticides. Chlordane was detected in Soil 38 and Soil 40 at concentrations of 130 and 270 mg/kg, respectively. No other herbicides or pesticides were detected.

Sediments

FBA 1 is isolated away from Crosses Run and therefore no sediment samples are associated with this unit.

Groundwater

Monitoring wells MW-21, MW-28, and MW-31 have been sampled quarterly since November 1996. MW-21 is located on the north side (upgradient) of FBA 1. MW-28 and MW-31 are both located on the south side (downgradient) of FBA 1 (Figure 2.7). Groundwater was analyzed for inorganics, pesticides, herbicides, SVOCs, VOCs, and several water quality parameters. The groundwater analytical results are summarized in Table 2.4.

Inorganic constituents have been detected at ranges typical of background levels. Pesticides were not detected in sampling from the monitoring wells. The herbicide 2,4-dichlorophenoxyacetic acid was detected in MW-28 at a concentration of 0.14 μ g/l during the June 1998 sampling event (B&N, 1998b).

The SVOC bis (2-ethylhexyl) phthalate was detected in MW-31 at a concentration of 3.8 μ g/l during the February 1998 sampling event. Bis (2-ethylhexyl) phthalate is a common plasticizer used in laboratory containers. VOCs detected included low levels of methylene chloride, toluene, and acetone, considered common laboratory and/or laboratory container artifacts, have been occasionally detected in groundwater. Acetone was detected in MW-31 at a concentration of 5.67 μ g/l during the August 1997 sampling event. Methylene chloride was detected in MW-28 and MW-31 at concentrations of 1.0 μ g/l and 1.2 μ g/l, respectively, during the May 1997 sampling event. Toluene was detected in MW-28 at concentrations of 0.9 μ g/l and 0.410 μ g/l during the May 1997 sampling events, respectively. Toluene was also detected in MW-31 during the August 1997 sampling event at a concentration of 0.470 μ g/l.

Ammonia and nitrate/nitrite concentrations were relatively low in groundwater samples collected from MW-21, MW-28, and MW-31. The low concentrations of ammonia and nitrate/nitrite indicate that groundwater is not impacted by FBA 1 (B&N, 1998b).

2.4.6.3 Interim Measures

To reduce sediment loading from exposed waste material to Crosses Run via runoff, silt fencing was installed in March 1997. The silt fencing was installed along the south side of FBA 1 between the access road to Landfill 4 and Landfill 5 and the Conrail railroad tracks (Figure 2.7) (B&N, 1998b).

2.4.7 Field Broadcast Area 2, and Former Ponds 7 and 8

FBA 2 is located in the northern portion of the facility (Plate 1). The limits of FBA 2 are defined by the Conrail rail line to the north and east, north branch of Crosses Run to the south, and the fence line/property boundary to the west (Figure 2.8) (B&N, 1997a). The limits of waste for FBA 2 were determined based on aerial photographs, site inspections, interviews of Scotts employees, and physical boundaries (B&N, 1998c). Former Ponds 7 and 8 are located in the southern portion of FBA 2. Former Pond 7 is directly north of former Pond 8 (B&N, 1998d).

2.4.7.1 Site History

FBA 2 was used for the spreading of off-spec fertilizers and other lawn care products from 1970 to 1971. Much of the waste deposited in the landfills and field broadcast areas was off-spec vermiculite waste. It is unknown what quantities/concentrations of pesticides or herbicides were contained in the vermiculite waste (B&N, 1996a). FBA 2 is currently covered in grass and periodically mowed by the Scotts Company (B&N, 1997a).

During the 1998 rail spur construction, over-excavated native soil from the footprint of the rail spur was piled on FBA 2. This distinguishable mound of soil was covered with clean material. Additionally, during construction of the rail spur in the area of FBA 2, a pocket of vermiculite of approximately 2 cubic yards was encountered. The vermiculite was completely removed and placed on Landfill 1 prior to its capping.

Former Ponds 7 and 8 appear to have been part of the 8 pond system utilized in process recycle streams. The Phase I Environmental Site Assessment (B&N, 1997c) lists Former Ponds 7 and 8 as potential release locations that were closed. No further documentation has been noted on the historical use/purpose of Former Ponds 7 and 8.

2.4.7.2 Nature and Extent of Potential Contamination

Soil

Ohio EPA collected two soil samples (OMS-SO-17 and OMS-SO-18) for analysis of SVOCs, pesticides, herbicides, ammonia, nitrate/nitrite, and inorganics. The location of the soil samples is shown on Figure 2.8. The soil analytical results are summarized in Table 2.5. Chlordane, manganese, nitrate/nitrite and mercury were detected in OMS-SO-18 at concentrations of 930.0 μ g/kg, 494.0 mg/kg, 1,210.0 mg/kg and 0.15 mg/kg, respectively. Chlordane, nitrate/nitrite and mercury were detected in OMS-SO-17 at concentrations of 2,000.0 μ g/kg, 1,070.0 mg/kg, and 0.29 MG/KG, respectively. The depths the soil samples were collected from is not recorded.

During December 1997 sampling conducted by Burgess & Niple (B&N, 1998b), six soil samples were collected from at FBA 2 for analysis of pesticides, herbicides, and SVOCs. Three soil samples (Soil 1, Soil 2, and Soil 5A) were collected from a depth interval of 0 to 3 inches. One soil sample (Soil 4) was collected from a depth interval of 4 to 6 inches and another (Soil 5B) was collected from a depth interval of 12 to 18 inches. The location of the soil samples were biased towards areas where visual evidence of vermiculite existed (Figure 2.8). The soil analytical results are summarized in Table 2.5. Chlordane was detected in four of seven soil samples at concentrations ranging between 140 μ g/kg (Soil 1) to 11,000 μ g/kg (Soil 5A). 4,4'-DDT was detected in Soil 5A at a concentration of 350 μ g/kg. Dicamba was detected at concentrations ranging from 1,300 μ g/kg (benzo(b)fluoranthene) to 3,200 μ g/kg (pyrene) (B&N, 1998b).

Sediment

FBA 2 is isolated away from Crosses Run and therefore no sediment samples are associated with this unit.

Groundwater

Monitoring well MW-27, located in the southeast corner of FBA 2, has been sampled quarterly since November 1996 (Figure 2.8). Groundwater was analyzed for inorganics, pesticides, herbicides, SVOCs, VOCs, and several water quality parameters. Groundwater analytical results for this well are summarized in Table 2.4.

Inorganic constituents were detected at ranges typical of background levels. No pesticides or herbicides were detected in groundwater samples collected from MW-27.

The only SVOC detected at MW-27 was bis (2-ethylhexyl) phthalate at a concentration of 8.2 μ g/l during the May 1997 sampling event. Bis (2-ethylhexyl) phthalate is a common plasticizer used in laboratory containers (B&N, 1998b). VOC results indicated low levels of methylene chloride, considered a common laboratory and/or laboratory container artifact, has been occasionally detected in groundwater. Methylene chloride was detected in MW-27 during the May 1997 sampling event at a concentration of 2.9 μ g/l.

Ammonia and nitrate/nitrite concentrations were relatively low in groundwater samples collected from MW-27. Ammonia was detected in MW-27 at concentrations ranging from 0.87 mg/l (November 1997) to 1.5 mg/l (November 1996). Nitrate/nitrite was detected in MW-27 at concentrations ranging from 0.05 mg/l (November 1996) to 0.18 mg/l (June 1998) (B&N, 1998b).

2.4.7.3 Interim Measures

To reduce sediment loading from exposed waste material to Crosses Run via runoff, silt fencing was installed in March 1997. The silt fencing was installed along the western half of the south side of FBA 2 (Figure 2.8) (B&N, 1998b).

2.4.8 Former Pond 2

Pond 2 is located in the northwestern corner of the Scotts' property, northwest of Pond 1 and directly south of Pond 3 (Figure 2.9).

2.4.8.1 Site History

Former Pond 2 was actively operated from 1955 to the 1980s. The historical use/purpose of Pond 2 is not known, but at one time it was believed to be connected by a ditch to Pond 1 (B&N, 1997a). Pond 1 was a surface settling impoundment for the reuse/recycling of water from the pesticide formulation process. Influent to Pond 1 may have contained 2,4-D, mercuric and/or arsenic compounds (B&N, 1997a). After operations ceased, Pond 2 was backfilled and planted with grass to match the surrounding area. The date Pond 2 was backfilled is not known and the source of the backfill material is not known.

2.4.8.2 Nature and Extent of Potential Contamination

Soil

A Simco direct-push hydraulic soil probe was used to complete six soil borings in the former Pond 2 area. The borings were conducted to determine the extent of the pond based on the presence/absence of vermiculite in the boring. One soil sample from each boring was collected and analyzed for herbicides, pesticides, arsenic, and mercury. Chlordane was detected at concentrations ranging from 0.46 mg/kg (B-75) to 10.3 mg/kg (B-74). Mercury was detected at concentrations ranging from 0.027 mg/kg (B73) to 0.85 mg/kg (B-74). The completion date and locations of these six soil borings is not known. The soil boring depths ranged from 6 feet to 10 feet. No vermiculite or other materials indicative of a sediment layer were noted in any of the borings. The soil consisted of compact gray-brown silty clay containing scattered fine gravel. The absence of a sediment layer in the backfill materials indicates that the sediments were removed from Pond 2 prior to backfilling with native soil backfill (B&N, 1998e).

One soil sample (Soil 37B) was collected from the waste material in Pond 2 during the December 1997 sampling event (Figure 2.9). Soil sample, Soil 37B was collected from a depth interval of 24 to 30 inches below land surface. The soil sample was analyzed for pesticides, herbicides, and SVOCs. The soil analytical results are summarized in Table 2.5. Chlordane was detected at a concentration of 240 µg/kg. Herbicides and SVOCs were not detected in soil sample Soil 37B.

Soil samples were also collected during the December 1997 sampling event from the vicinity of the drainage channel connecting Pond 1 to Pond 2 (Figure 2.9). One soil sample (Soil 15A) was collected from a depth interval of 0 to 3 inches, two soil samples (Soil 13 and Soil 14) were collected from a depth interval of 0 to 6 inches, and one soil sample (Soil 15B) was collected from a depth interval of 18 to 24 inches. Each soil sample was analyzed for pesticides, herbicides, and SVOCs. The soil analytical results are summarized in Table 2.5. No pesticides, herbicides, or SVOCs were detected in these soil samples (B&N, 1998b).

Sediment

Pond 2 is isolated away from Crosses Run and therefore no sediment samples are associated with this unit.

Groundwater

Groundwater monitoring wells, MW-38 and MW-39, were installed down gradient of Pond 2 in December 1997 (B&N, 1998b). MW-38 is located east-southeast of Pond 2 and MW-39 is located south-southeast of Pond 2 (Figure 2.9). The groundwater analytical results are summarized in Table 2.4. No inorganics, pesticides, herbicides, or VOCs above background levels were detected in these wells. Nitrate was detected in MW-38 at a concentration of 38 mg/l. This is a shallow well (17 feet deep). Preclosure monitoring data from Pond 1 also showed elevated nitrate concentrations in groundwater (B&N, 1998b).

2.4.8.3 Interim Measures

To reduce sediment loading from exposed waste material to Crosses Run via runoff, silt fencing was installed in March 1997. The silt fencing was installed around Ponds 2 and 3 (Figure 2.9) (B&N, 1998b). No other interim measures have been conducted at this unit.

2.4.9 Former Pond 3

Former Pond 3 is located in the northwestern corner of the Scotts' property, north of Former Pond 2 and south of FBA 2 (Figure 2.9).

2.4.9.1 Site History

Former Pond 3 appears to have been (most likely) part of the eight pond system utilized in process recycle streams. The Phase I Environmental Site Assessment (B&N, 1997c) lists former Pond 3 as a potential release location that was closed. No further documentation has been noted on the historical use/purpose of Former Pond 3.

2.4.9.2 Nature And Extent Of Potential Contamination

No analytical data is available for Former Pond 3.

2.4.9.3 Interim Measures

To reduce sediment loading from exposed waste material to Crosses Run via runoff, silt fencing was installed in March 1997. The silt fencing was installed around Ponds 2 and 3 (Figure 2.9) (B&N, 1998b). No other interim measures have been conducted at this unit.

2.4.10 Former Pond 6

Former Pond 6 is located in the northwestern corner of the Scotts' property, southwest of Pond 1 and north of Ponds 4 and 4A (Figure 2.9).

2.4.10.1 Site History

Former Pond 6 appears to have been (most likely) part of the eight pond system utilized in process recycle streams. The Phase I Environmental Site Assessment (B&N, 1997c) lists Former Pond 6 as a potential release location that was closed. No further documentation has been noted on the historical use/purpose of Former Pond 6.

2.4.10.2 Nature And Extent Of Potential Contamination

No analytical data is available for Former Pond 6.

2.4.10.3 Interim Measures

No interim measures have been noted at Former Pond 6.

2.4.11 Crosses Run

Drainage from the facility flows along the north and south branches of Crosses Run which join together near the intersection of Scottslawn Road and Industrial Parkway (Plate 6). The main branch of Crosses Run flows north through the Scotts park, under U.S. Route 33 and north of Landfill 3 toward Mill Creek. Crosses Run intersects Mill Creek approximately 0.75-mile north of The Scotts Company facility. Mill Creek discharges into O'Shaughnessy Reservoir on the

Scioto River approximately 10 miles downstream. O'Shaughnessy Reservoir is utilized by the city of Columbus in its public water supply plan (Ohio EPA, 1995).

2.4.11.1 Site History

Several documented releases of hazardous substances or petroleum compounds from the operations and activities on the Scotts property have involved Crosses Run. A release of 2,600 gallons of No. 2 fuel oil to the south branch of Crosses Run occurred in 1982. The south branch of Crosses Run was dammed up and 95 percent of the fuel oil was captured and removed. In addition, impacts to Mill Creek were limited by the placement of temporary dams, straw, and sorbant blankets in Mill Creek. No impacts to soil, animal, or plant species were reported to have occurred.

On May 7, 1987, 35,000 gallons of ammonium hydroxide was spilled as a result of a pump malfunction at Scotts that allowed liquids from their holding pond to enter a branch of Crosses Run and subsequently Mill Creek. The spill resulted in a fish kill along portions of Mill Creek located in Union and Delaware Counties, south of Marysville, Ohio. Subsequent to the release the Ohio Department of Natural Resources' (ODNR's) Division of Wildlife (DOW) conducted water quality sampling and field investigations, and concluded that Mill Creek had been impacted by ammonium hydroxide which resulted in a total of 8,047 animal specimen, mostly fish, killed (B&N, 1997b).

In 1994, five gallons of gasoline leaked from a vehicle onto the parking lot. One gallon of the gasoline was released to the north branch of Crosses Run (B&N, 1997a).

Until recently, there were five National Pollutant Discharge Elimination System (NPDES) permitted outfalls which discharge to Crosses Run (Plate 6). The five NPDES outfalls were associated with five decommissioned sanitary nonprocess water/wastewater treatment package plants. The plants treated water through digestion, chlorinator, dechlorinator, and a sand filter (B&N, 1997b). Scotts maintained testing and reporting of effluent quality with the reporting of any violations of permit exceedences to the Ohio EPA on a monthly basis (B&N, 1997a). The five treatment package plant locations and the stream into which the effluent discharged are indicated on the following table:

Outfall	Plant Location	Effluent Discharge Point
001	North of Trionize Bldg.	North branch of Crosses Run
002	West of Polyform Bldg.	West branch of Crosses Run
003	South of Campbell Barn	South branch of Crosses Run
004	West of Gilchrest Barn	North branch of Crosses Run
005	Adjacent to swimming pool	Crosses Run

Exceedences of parameters tested in the effluent discharges of these facilities over the years 1992 through 1996 have included ammonia, suspended solids, dissolved oxygen, carbonators biochemical oxygen demand (CBOD), temperature, pH, fecal coliform, and chlorine residual.

OEPA effluent sampling on February 21, 1996 revealed NPDES permit violations for ammonia at Outfalls 001 and 002. OEPA toxicity testing performed on the samples indicated that the discharges from Outfalls 001 and 002 were acutely toxic to aquatic life. Additional OEPA sampling in 1995 and 1996 detected the presence of pesticides in the effluent at these outfall locations. Pesticides including atrazine, diazinon, pendimethalin, cyanizine, and pentachloronitrobenzene (PCNB) were detected.

Other outfalls at The Scotts facility covered by the NPDES permit include:

Outfall 006	Boiler blowdown water
Outfall 007	Trionized boiler blowdown water
Outfall 008	Noncontact Trionize cooling water
Outfall 009	Swimming pool outfall
Outfall 010	Recycle 1; closed system-zero discharge

2.4.11.2 Nature and Extent of Potential Contamination

The Ohio EPA Division of Surface Water conducted biological and water quality studies of Mill Creek and selected tributaries in 1986, 1991, and 1995 (Ohio EPA, 1987, 1991, and 1997). Crosses Run has been designated a Warm Water Habitat (WWH) stream. The evaluation of biological communities in the years 1986, 1991, and 1995 has resulted in the determination that Crosses Run is very poor to poor, a condition which is reported by Ohio EPA to have resulted from water quality exceedences for ammonia, pesticides, fecal coliform bacteria, and dissolved oxygen, and sediment contamination from pesticides and organic compounds. The stream has been identified to have a very low fish community index, a condition which has had very little improvement since 1986. This condition was determined to be present prior to the reported fish kill in May 1987 (B&N, 1997a).

Sediment

Five sediment samples (Crosses Run RM 2.8, RM 2.0, and RM 0.8, and North Branch Crosses Run RM 1.2 and RM 0.1) were collected from Crosses Run during the 1995 Mill Creek study (Plate 6) (Ohio EPA, 1995). The sediment samples were analyzed for VOCs, SVOCs, pesticides, PCBs, and inorganics. The sediment analytical results are summarized in Table 2.6.

During the 1995 Mill Creek study VOCs and PCBs were not detected in sediment samples. Numerous SVOCs were detected in Crosses Run RM 2.0 and North Branch Crosses Run RM 0.1 at concentrations ranging from 0.8 mg/kg (acenaphthene at Crosses Run RM 2.0) to 17.6 mg/kg (fluoranthene at North Branch Crosses Run RM 0.1). Heptachlor was detected in Crosses Run RM 2.0 at a concentration of 5.9 μ g/kg. Dieldrin was detected in North Branch Crosses Run RM 0.1 and Crosses Run RM 2.0 at concentrations of 20 μ g/kg and 28 μ g/kg, respectively. The pesticide 4,4'-DDT was detected in Crosses Run RM 0.8 and RM 2.0 and North Branch Crosses Run RM 0.1 at concentrations 20 μ g/kg, 16 μ g/kg, and 14 μ g/kg, respectively. The pesticide 4,4'-DDD was detected in Crosses Run RM 0.8 and RM 2.0 and North Branch Crosses Run RM 0.1 at concentrations 20 μ g/kg, and 17 μ g/kg, respectively. Methoxychlor was detected at concentrations of 29 μ g/kg (Crosses Run RM 0.1). Heptachlor epoxide was detected at concentrations of 14 μ g/kg (Crosses Run RM 0.8) and 16 μ g/kg (Crosses Run RM 2.0).

On December 8, 1994, Ohio EPA collected three sediment samples (OMS-SD-15, OMS-SD-16, and OMS-SD-03) from Crosses Run. The sediment samples were analyzed for VOCs, SVOCs, pesticides, herbicides, inorganics, ammonia, nitrate/nitrite, and PCBs. The sediment analytical results are presented in Plate 6 and summarized in Table 2.6. VOCs were not detected in sediment samples. Benzo(a)pyrene was detected in OMS-SD-16 and OMS-SD-03 at concentrations of 380.0 µg/kg and 390.0 µg/kg, respectively. Herbicides were not detected in sediment samples.

Chlordane was detected in the sediment samples at concentrations of 3,900.0 μ g/kg (OMS-SD-15), 5,400.0 μ g/kg (OMS-SD-16), and 7,100.0 μ g/kg (OMS-SD-03). Aldrin was also detected in OMS-SD-15 at a concentration of 49.0 μ g/kg. Ammonia was detected in OMS-SD-15 at a concentration of 1,330.0 μ g/kg.

Ohio EPA DERR collected sediment samples from Mill Creek and selected tributaries in August 1997 (Ohio EPA, 1998b). Sediment samples CR-1, CR-2, and CR-2 (dup) were collected in Crosses Run, downgradient of Scotts Company (Plate 6). Sediment samples CR-1, CR-2, and CR-2 (dup) were analyzed for pesticides and PCBs. Sediment sampling analytical results are summarized in Table 2.6.

Lindane in the Ohio EPA DERR sampling event was detected at a concentration of 24 μ g/kg in CR-2 (dup). Heptachlor was detected at concentrations of 4,500 J μ g/kg (CR-2) to 5,100 μ g/kg (CR-2 dup). Heptachlor epoxide was detected at concentrations of 7.5 J μ g/kg (CR-1), 77 J μ g/kg (CR-2 dup), and 88 J μ g/kg (CR-2). Endosullfan I was detected at a concentration of 200 μ g/kg (CR-1). DDE-4,4 was detected at a concentration of 270 J μ g/kg (CR-2 dup). Endrin was detected at a concentration of 12 J μ g/kg (CR-1) and 440 J μ g/kg (CR-2 dup). DDD-4,4 was detected at a concentration of 16 J μ g/kg (CR-1), 220 J μ g/kg (CR-2), and 220 J μ g/kg (CR-2 dup). Endosulfan sulfate was detected at a concentration of 29 J μ g/kg (CR-2) and 600 J μ g/kg (CR-2 dup). DDT-4,4 was detected at a concentration of 29 J μ g/kg (CR-1), 850 J μ g/kg (CR-2), and 1,900 J μ g/kg (CR-2 dup). Endrin aldehyde was detected at a concentration of 4.9 J μ g/kg (CR-1) and 16 J μ g/kg (CR-2 dup). The pesticide a-chlordane was detected at a concentration of 180 μ g/kg (CR-1), 8,800 J μ g/kg (CR-2 dup), and 9,700 μ g/kg (CR-2). The pesticide g-chlordane was detected at a concentration of 160 μ g/kg (CR-1), 9,800 J μ g/kg (CR-2), and 11,000 J μ g/kg (CR-2 dup). PCBs were not detected in sediment samples CR-1, CR-2, and CR-2 (dup) (Ohio EPA, 1998b).

To further evaluate possible impacts to Crosses Run via runoff over the eight potential source areas, 22 sediment samples (Sediment 1 through Sediment 22) were collected by Burgess & Niple in December 1997 (Plate 6). The sediment samples were analyzed for pesticides, herbicides, and SVOCs. The analytical results for the sediment samples are summarized in Table 2.6. The pesticide chlordane was detected in 11 sediment samples at concentrations ranging from 110 µg/kg (Sediment 14) to 2,500 µg/kg (Sediment 1). The pesticide 4,4'-DDT was detected at concentrations of 100 µg/kg (Sediment 18), 150 µg/kg (Sediment 16), and 340 µg/kg (Sediment 1). 4,4'-DDD was detected in sample Sediment 18 at a concentration of 230 µg/kg. The herbicide 2.4-D was detected in sample Sediment 1 at a concentration of 150 µg/kg. Pesticides and herbicides were not detected in sediment samples collected off the Scotts property. SVOCs, primarily PAHs, were detected in Sediment 1, Sediment 5, Sediment 7, and Sediment 12 at concentrations ranging from 900 μ g/kg (benzo (a) anthracene in Sediment 1) to 560,000 μ g/kg (fluoranthene in Sediment 7). Samples Sediment 1, Sediment 7, and Sediment 12 are located near Landfills 1, 4, and 2, respectively. Sample Sediment 5 is located near the intersection of Industrial Parkway and Scottslawn Road. The SVOCs present in Sediment 5 may be due to a spill at the road intersection (B&N, 1998b) or due to runoff from black-topped state and county road surfaces immediately upstream of this sampling site.

To confirm the results from the December 1997 sampling event, an additional 34 stream sediment samples (Sediment 1 through 23, 24a through 24d, 25a through 25d, 26, Sediment Duplicate-1, and Sediment Duplicate-2) were collected by Burgess & Niple in September 1998 (Plate 6). Each of the sediment samples were analyzed for pesticides, herbicides, arsenic, mercury, and total

organic carbon. Twelve samples (Sediment 2, 6, 8, 10, 11, 13, 16, 17, 18, 21, 22, and 26) were analyzed for reactive sulfide and alkalinity. Eight samples (Sediment 3, 5, 7, 12, 15, 20, 23, and Sediment duplicate-1) were analyzed for SVOCs. The analytical results for the sediment samples are summarized in Table 2.6. The pesticide chlordane was detected in 31 sediment samples at concentrations ranging from 0.16 mg/kg (Sediment 18) to 33 mg/kg (Sediment 25c). SVOCs were detected in four sediment samples at concentrations ranging from 373 μ g/kg (dibenzofuran in Sediment 23) to 62,124 μ g/kg (fluoranthene in Sediment 5). Arsenic was detected in 25 sediment 12) to 24 mg/kg (Sediment 1). Mercury was detected in 25 sediment samples at concentrations ranging from 0.0066 mg/kg (Sediment 17) to 0.48 mg/kg (Sediment 20). Herbicides were not detected in the sediment samples collected during the September 1998 sampling event.

Surface Water

Five surface water samples (Crosses Run RM 2.8, RM 2.0, and RM 0.8, and North Branch Crosses Run RM 1.2 and RM 0.1) were collected from Crosses Run during the 1995 Mill Creek study (Plate 6) (Ohio EPA, 1995). The samples were analyzed for VOCs, SVOCs, pesticides, and PCBs. The surface water analytical results are summarized in Table 2.7.

PCBs were not detected in surface water samples. Chloroform was detected in Crosses Run RM 2.0 at a concentration of 2.3 µg/l. Numerous SVOCs were detected in Crosses Run RM 2.0 and North Branch Crosses Run RM 0.1 at concentrations ranging from 2.1 µg/l (benzo[g,h,i]perylene at Crosses Run RM 2.0 and North Branch Crosses Run RM 0.1) to 7.0 µg/l (benzo[k] fluoranthene at North Branch Crosses Run). Heptachlor was detected in North Branch Crosses Run RM 0.9 at a concentration of 0.003 µg/l. Dieldrin was detected in North Branch Crosses Run RM 0.9 and RM 0.1 and Crosses Run RM 2.0 at concentrations of 0.003 µg/l, 0.103 µg/l, and 0.160 µg/l, respectively. The pesticide 4.4'-DDE was detected in North Branch Crosses Run RM 0.1 at a concentration of 0.067 µg/l. The pesticide 4,4'-DDD was detected in Crosses Run RM 2.0 at a concentration of 0.014 µg/l. Aldrin was detected in North Branch Crosses Run RM 0.9 at a concentration of 0.023 μ g/l. The pesticide a-BHC was detected at concentrations of 0.010 μ g/l (Crosses Run RM 2.8) and 0.015 µg/l (North Branch Crosses Run RM 0.9). The pesticide d-BHC was detected at concentrations of 0.002 μ g/l (Crosses Run RM 2.8) and 0.128 μ g/l (Crosses Run RM 2.0). Endosulfan I was detected at a concentration of 0.009 µg/l at North Branch Crosses Run RM 0.9. Endosulfan II was detected at concentrations of 0.004 µg/l (North Branch Crosses Run RM 0.9), 0.005 µg/l (Crosses Run RM 2.0), and 0.017 µg/l (North Branch Crosses Run RM 0.1). Endosulfan sulfate was detected in Crosses Run RM 2.0 at a concentration of 0.046 µg/l. Endrin was detected at concentrations of 0.011 µg/l (Crosses Run RM 0.8) and 0.027 µg/l (North Branch Crosses Run RM 0.1). Heptachlor epoxide was detected at concentrations of 0.004 µg/l (Crosses Run RM 2.8) and 0.005 μ g/l (Crosses Run RM 0.8).

Ohio EPA collected three surface water (OMS-SW-14, OMS-SW-06, and OMS-SW-01) from Crosses Run. The surface water samples were analyzed for VOCs, SVOCs, pesticides, herbicides, inorganics, ammonia, nitrate/nitrite, and PCBs. The surface water analytical results are presented in Plate 6 and summarized in 2.7. The VOCs 2-butanone and toluene were detected in OMS-SW-01 at concentrations of 13.0 μ g/l and 6.1 μ g/l, respectively. SVOCs were not detected in surface water samples. The herbicide 2,4-D was detected in the surface water samples at concentrations of 4.6 μ g/l (OMS-SW-06), 15.0 μ g/l (OMS-SW-14), and 62.0 μ g/l (OMS-SW-01). Several pesticides were detected in surface water samples OMS-SW-01 and OMS-SW-14 at

concentrations ranging from 0.05 μ g/l (heptachlor and heptachlor epoxide in OMS-SW-14) to 0.26 μ g/l (endosulfan II in OMS-SW-01).

Surface water samples (CR-1, CR-2, and CR-2 duplicate) were collected by DERR in August 1997 from Crosses Run, downgradient of Scotts Company and analyzed for pesticides (Plate 6) (Ohio EPA, 1998b). Surface water analytical results are summarized in 2.7. The pesticides d-BHC and aldrin were detected in CR-2 (dup) at concentrations of 0.037 J μ g/l and 0.05 J μ g/l, respectively. Endosulfan I and endosulfan sulfate were detected in CR-2 at concentrations of 0.066 J μ g/l and 0.14 J μ g/l, respectively. The pesticides 4,4'-DDD and 4,4'-DDT were detected in CR-2 at concentrations of 0.046 J μ g/l and 0.28 J μ g/l, respectively. The pesticides a-chlordane and g-chlordane were detected in CR-2 at concentrations of 0.056 J μ g/l and 0.026 J μ g/l, respectively. Pesticides were not detected in surface water sample CR-1 (Ohio EPA, 1998b).

Quarterly Sampling

Burgess & Niple have collected surface water and sediment samples quarterly from Crosses Run since November 1996 in three locations (SW-1/SS-1, SW-2/SS-2, and SW-3/SS-3) (Plate 6). The surface water and sediment samples were analyzed for VOCs, SVOCs, herbicides, pesticides, and inorganics. Surface water was also analyzed for several water quality parameters. The sediment and surface water analytical results are summarized in Table 2.6 and 2.7, respectively.

Other than low levels of acetone and methylene chloride, common laboratory artifacts, no VOCs were detected in surface water or sediment samples. SVOCs were detected in sediment samples from location SS-3 in November 1996 and February 1997 at concentrations ranging from 636 μ g/kg (phenanthrene) to 1,204 μ g/kg (pyrene). SVOCs were not detected in surface water samples. Mercury has been detected in sediment samples at concentrations ranging from 0.019 mg/kg (location SS-1 in February 1997) to 1.12 mg/kg (location SS-3 in November 1997). The remaining inorganics in the sediment samples were within normal ranges for Ohio soils. The concentrations of inorganics in the surface water samples were within ranges normal for surface water (B&N, 1998b).

The pesticide chlordane has been consistently detected in sediment sample from location SS-3 at concentrations ranging from 410 μ g/kg (February 1998) to 14,000 μ g/kg (November 1997). Chlordane has also been detected with less frequency in sediment samples from locations SS-1 and SS-2 at concentrations ranging from 11.40 μ g/kg (SS-1 in August 1997) to 1,900 μ g/kg (SS-1 in June 1998). Other pesticides have been detected in the sediment samples, primarily during the May 1997 and August 1997 sampling events. Chlordane was detected in surface water sample SW-3 at a concentration of 0.250 μ g/l in August 1997. Pesticides were not detected in any other surface water samples (B&N, 1998b).

2,4-D has been detected in six surface water samples at concentrations ranging from 0.42 μ g/l (SW-2 in November 1997) to 12.0 μ g/l (SW-3 in November 1996). 2,4-DB was detected in SW-3 in November 1997 at a concentration of 9.5 μ g/l. Dicamba was detected in four surface water samples at concentrations ranging from 0.61 μ g/l (SW-3 on May 1997) to 2.5 μ g/l (SW-3 on November 1996). Herbicides were not detected in the sediment samples (Burgess & Niple, Limited, 1998b).

2.4.11.3 Interim Measures

To reduce sediment loading from exposed waste material to Crosses Run via runoff, silt fencing was installed in March 1997. Over 7,200 linear feet of fencing was installed at the locations shown on Plate 1. Silt fencing was installed around the five landfills, two field broadcast areas, and Ponds 2 and 3 (B&N, 1998b).

In addition, the soil cover was redistributed at Landfills 1 and Landfill 3 to cover exposed waste brought up by the burrowing animals. The silt fencing at Landfill 3 was limited to the area on Scotts property. There is a sizable area of exposed waste on adjacent Ohio Department of Transportation (ODOT) property next to the highway ditch. No interim measures have been performed in this area where sediment was most likely to be transported by stormwater into the adjacent waterways. In addition, areas of heavy vegetation were cleared and will be mowed regularly during the growing season in order to reduce burrowing activity (B&N, 1998b).

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Section 2 Tables

Table 2.1	Groundwater Elevations from Quarterly Sampling Events with Historical Maximum	, Minimum, and Average Groundwater Elevation.	The Scotts Company, Marysville,
	Ohio.		

	Top of PVC Elevation	Groundwater Elevation						Maximum	Minimum	Mean				
Well ID	(feet amsl)	11/19/96	12/11/96	1/30/97	2/10/97	5/19/97	8/26/97	11/18/97	2/24/98	6/22/98	10/15/98	Value	Value	Value
MW-21	987.85	958.28	959.20	960.25	960.38	961.20	959.29	957.29	959.12	959.83	957.05	961.20	957.05	959.19
MW-22	975.67	956:02	956.34	959.81	960.18	960.04	957.83	956.52	957.74	958.55	956.04	960.18	956.02	957.91
MW-23	973.25	956.82	957.59	959.58	959.87	960.51	958.29	956.57	958.41	958.92	956.54	960.51	956.54	958.31
MW-24	978.85	957.49	957.92	960.44	959.85	960.36	958.37	956.67	958.46	959.13	956.53	960.44	956.53	958.52
MW-25	990.45	959.60	960.38	961.12	961.41	962.34	960.43	958.77	960.29	NA	NA	962.34	958.77	960.54
MW-26	991.90	960.45	960.99	961.67	961.86	962.55	960.91	959.58	960.66	NA	NA	962.55	959.58	961.08
MW-27	987.91	960.30	961.33	962.11	962.38	963.14	961.74	960.16	961.56	962.43	959.96	963.14	959.96	961.51
MW-28	981.58	956. 82	958.30	959.49	959.69	960.51	958.75	956.71	958.47	959.18	956.86	960.51	956.71	958.48
MW-29	989.02	NA	NA	962.02	962.58	967.15	966.43	962.75	961.52	965.68	963.11	967.15	961.52	963.91
MW-30	985.25	955.70	957.51	958.87	959.00	959.89	957.98	955.95	957.79	958.40	955.49	959.89	955.49	957.66
MW-31	983.22	969.48	970.51	971.55	971.78	972.20	970.74	968.71	970.98	971.54	968.85	972.20	968.71	970.63
MW-32	961.86	955.41	956.72	957.62	957.91	958.65	956.85	954.63	956.88	957.24	955.65	958.65	954.63	956.76
MW-33	966.24	954.53	955.79	956.83	956.26	957.57	955.82	953.75	956.23	956.41	953.12	957.57	953.12	955.63
MW-34	965.45	954.63	955.61	956.24	956.32	957.35	955.66	954.24	955.96	956.31	954.13	957.35	954.13	955.65
MW-35	979.89	NA	NA	NA	NA	NA	NA	NA	974.44	973.61	970.98	974.44	970.98	973.01
MW-36	985.65	NA	NA	NA	NA	NA	NA	NA	958.63	959.55	956.54	959.55	956.54	958.24
MW-37	963.09	NA	NA	NA	NA	NA	NA	NA	956.12	956.97	954.12	956.97	954.12	955.74
MW-38	988.70	NA	NA	NA	NA	NA	NA	NA	985.15	983.49	980.90	985.15	980.90	983.18
MW-39	989.17	NA	NA	NA	NA	NA	NA	NA	960.33	961.07	958.75	961.07	958.75	960.05
MW-40	985.21	NA	NA	NA	NA	NA	NA	NA	975.98	977.99	975.25	977.99	975.25	976.41
MW-41	998.94	NA	NA	NA	NA	NA	NA	NA	NA	NA	958.29	958.29	958.29	958.29
MW-42	995.60	NA	NA	NA	NA	NA	NA	NA	NA	NA	959.16	959.16	959.16	959.16
BW-18A	991.88	959.32	960.04	960.78	NM	NM	NM	958.27	959.83	960.55	958.31	960. 78	958.27	959.59
MW-7A	990.66	958.44	959.49	960.38	NM	961.48	959.62	957.81	959.50	960.09	957.81	961.48	957.81	959.40
MW-8A	992.19	959.35	960.25	961.03	NM	962.33	960.33	958.65	960.22	960.81	958.60	962.33	958.60	960.17
TW-10A	991.04	958.99	959.93	960.73	NM	NM	NM	958.18	959.89	960.50	958.26	960.73	958.18	959.50
TW-11A	989.66	NM	959.11	959.98	NM	NM	NM	957.39	NA	NA	NA	959.98	957.39	958.83
TW-12A	991.33	957.19	959.07	959.64	NM	961.03	959.14	957.51	958.99	959.63	957.51	961.03	957.19	958.86

feet amsl = feet above mean sea level

NA = Not Available

NM = Not Measured

	TW-8	TW-10B	MW-23	MW-28	MW-31	MW-37	MW-39
K (cm/sec)	2.37 x 10 ⁻⁷	4.65 x 10 ⁻⁶	3.27 x 10 ⁻³	6.03 x 10 ⁻⁶	1.43 x 10 ⁻⁵	3.27 x 10 ⁻³	1.69 x 10 ⁻⁶
K (ft/min)	4.67 x 10 ⁻⁷	9.15 x 10 ⁻⁶	6.43 x 10 ⁻³	1.19 x 10 ⁻⁵	2.81 x 10 ⁻⁵	6.44 x 10 ⁻³	3.32 x 10 ⁻³

Table 2.2 Results of Slug Test Analyses


Table 2.3 Monitoring Well Construction Details. The Scotts Company, Marysville, Ohio.

-- = Data Not Available.

		r			ľ	l	Γ		1	i		
			Ground	Top of			_	Top of	~			
	•		Surface	Casing	Casing	Boring	Screen	Screen	Casing/	Casing	Slot	Filter Pack
	Date	Driller's	Elevation	Elevation	Stick-up	Depth	Depth	Elevation	Screen	Diameter	Size	Length
Well #	Installed	Name	(feet amsl)	(feet amsl)	(feet)	(feet bgs)	(feet bgs)	(feet amsl)	Material	(inches)	(inches)	(feet)
MW-21	10/29/96	Bucksar	985.34	987.85	2.4	36	26-36	959.34	Sch. 40 PVC	2	0.010	12
MW-22	10/29/96	Bucksar	973.20	975.67	2.5	28	18-28	955.20	Sch. 40 PVC	2	0.010	12
MW-23	10/30/96	Bucksar	970.63	973.25	2.6	26	16-26	954.63	Sch. 40 PVC	2	0.010	12
MW-24	10/30/96	Bucksar	976.26	978.85	2.5	30	20 - 30	956.26	Sch. 40 PVC	2	0.010	12
MW-25	10/31/96	Bucksar	987.76	990.45	2.7	45	35-45	952.76	Sch. 40 PVC	2	0.010	12
MW-26	11/1/96	Bucksar	986.06	991.90	3	40	30-40	956.06	Sch. 40 PVC	2	0.010	12
MW-27	11/4/96	Bucksar	985.54	987.91	2.4	37	27-37	958.54	Sch. 40 PVC	2	0.010	12
MW-28	11/5/96	Bucksar	978.91	981.58	2.5	45	35-45	943.91	Sch. 40 PVC	2	0.010	12
MW-29	11/6/96	Bucksar	986.36	989.02	2.7	30	20-30	966.36	Sch. 40 PVC	2	0.010	12
MW-30	11/6/96	Bucksar	982.72	985.25	2.5	40	30-40	952.72	Sch. 40 PVC	2	0.010	12
MW-31	11/4/96	Bucksar	980.52	983.22	2.5	36	22-32	958.52	Sch. 40 PVC	2	0.010	12
MW-32	11/7/96	Bucksar	959.01	961.86	2.8	20	10-20	949.01	Sch. 40 PVC	2	0.010	12
MW-33	11/8/96	Bucksar	963.34	966.24	2.8	22	12-22	951.34	Sch. 40 PVC	2	0.010	12
MW-34	11/8/96	Bucksar	962.74	965.45	2.8	20	10-20	952.74	Sch. 40 PVC	2	0.010	12
MW-35	11/5/97	Bucksar		979.89	2.5	25	15-25		Sch. 40 PVC	2	0.010	12
MW-36	11/6/97	Bucksar		985.65	2.5	40	30-40		Sch. 40 PVC	2	0.010	12
MW-37	11/7/97	Bucksar		963.09	2.5	24	14-24		Sch. 40 PVC	2	0.010	12
MW-38	1/12/98	Bucksar		988.70	2.5	20	10-20		Sch. 40 PVC	2	0.010	12
MW-39	1/13/98	Bucksar		989.17		36	26-36		Sch. 40 PVC	2	0.010	12
MW-40	1/13/98	Bucksar		985.21	2.5	15	5-15		Sch. 40 PVC	2	0.010	12
MW-41	5/21/98	Lane Ohio				36	26-36		Sch. 40 PVC	2	0.010	12
MW-42	5/21/98	Lane Ohio				47	37-47		Sch. 40 PVC	2	0.010	14.5

Table 2.3 Monitoring Well Construction Details. The Scotts Company, Marysville, Ohio.

-- = Data Not Available

		1			MW-21							MW-22							MW-23			
PARAMETER NAME	UNITS	11/20/96	2/11/97	5/19/97	8/26/97	11/18/97	2/25/98	6/23/98	11/20/96	2/11/97	5/19/97	8/27/97	11/18/97	2/24/98	6/22/98	11/20/96	2/11/97	5/19/97	8/27/97	11/18/97	2/24/98	6/22/98
									-400							- 100						
Aluminum	ug/1	<500	<u>NA</u>	<120	<1,000	NA	NA	NA	<300	NA	<120	<1,000	NA		NA	< 300	NA NA	<120	<1,000	NA	NA	NA
Ammonia	<u>mg/1</u>	0.8	0.94	<u><1.3</u>	(1.5	0.60	0.74	0.70	0.62	0.57	<1.5	4.5	0.48	0.58	0.52	0.11	0.00	<1.5	4.5		<0.05	<0.05
Antumony	<u>ug/1</u>	<4			<30	<3.0				<4		< 50	<3.0	<3.0	< 3.0	0.2		<u> (0</u>	<50			<3.0
Arsenic	<u>ug/1</u>	6.7	12	18	<30			29	<u> </u>	<u>/.1</u>	<u> </u>	< 30	20	16	10				<30		3.8	(3.0
Banum		<100	<100	1 1	<20	<10	<10	<10	<100	<100		<20	<10	<10	<10	<100	<100		<20	18		12
Beyllium		<0.5	<0.5	<1.0	<10	<0.5	50.5	<0.5	<0.5	<0.3	<1.0	<10	<2.0	<0.5	<0.5	<0.3	<0.5	<1.0	<10	<0.5	<0.5	
Cadmium	<u>ug/l</u>	<1	NA NA	<1.0	<10	<u> <0.5</u>	<u> </u>	<u> </u>			<1.0		<0.5 NIA	×0.5	<0.5 NIA			<1.0	<10	<u> </u>	<u></u>	
	mg/1		<u>NA</u>	344	424	NA		NA (20	3/0	NA I	331	3/0	NA	NA (10		530	<u> </u>	4/4	517	NA		NA (20
Chromuum	<u>ur/1</u>		<100	513	<100			×20	<100	<2		<100	- <u> </u>	<u></u>	~20				<100			
CODAIL	ug/i	<100	<100		< 30	NA		NA	<100	<100	<0 	< 30	NA		NA -	<100	<100		<30		<u>NA</u>	<u>NA</u>
Copper	ug/i	<20	NA	413	<100	NA	NA	<u> </u>	<20	NA	<13	<100	NA	NA	NA	<20	NA	<10.0	<100	<u>NA</u>	- NA	<u>NA</u>
Herbicidea, SW8150	ug/l	BDL•	NA	BDL.	BDL	BDL*	BDL.	BDL*	BDL*	NA	BDL	BDL	BDL.	BDL.	BDL•	BDL•	NA	BDL•	BDL	BDL*	BDL*	BDL*
fron	mg/l	5.6	NA	7.68	2.77	NA	NA	NA	9.4	NA	8.82	B.14	<u>NA</u>	NA	NA	0.09	NA	0.481	<0.5	NA	NA	NA
Lead	<u>ug/1</u>	<2	NA	<6	<50	<2.0	<2.0	<2.0	<2	NA	<6	<50	2.4	<2.0	<2.0	<2	NA	<6	<50	<2.0	<2.0	<2.0
Magnesium	mg/l	310	NA	344	402	NA	NA	NA	240		239	254	NA	NA	NA	210	NA	240	244	<u>NA</u>	<u>NA</u>	NA NA
Manganese	ug/1		96	74	69	NA	NA	NA	140	100	94	102	NA	NA	NA	1,700	1500	1,440	2,050	NA	<u>NA</u>	NA
Mercury	<u>up/1</u>	<0.2	<0.2	<0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20	<0.2	<0.2	<0.2	<0.2	<0,2	<0.2	<0.20	<0.2	<0.2	< <u></u>	<0.2
Nickel	<u>ug/1</u>	89	41	<13	<100	<20	<20	<20	76	<40	<13	<100	<20	<20	<20	120	78	36	<100	36	43	28
Nitrate/Nitrite	mg/1	<0.05	<0.05	<0.40	< 0.20	0.12	<0.05	0.13	<0.05	0.06	<0.40	<0.20	0.06	0.06	0.34	2.6	0.27	<0.40	1.57	0.24	1.48	0.34
Pesticides, SW8081	ug/1	BDL•	BDL•	BDL•	BDL*	BDL•	BDL*	BDL*	BDL•	BDL*	BDL*	See Below	BDL*	BDL*	BDL*	BDL*	BDL*	See Below	BDL*	BDL•	BDL•	BDL*
Phosphorus, Total	mg/1	0.98		0.584	0.0730	NA	NA	NA	0.26	0.99	0.954	<0.020	NA	NA	NA	1.9	1.2	2.03	<0.020	NA	NA NA	NA
Potassium	mg/1	7.7	30	NA	7.0	NA	NA	NA	1	6.8	NA	5.8	NA	NA	NA	9.4	12	NA	7.2	NA	NA	NA
Selenium	ug/1	<5	NA	<6	<50	<15.0	<15.0	<15.0	<5	NA	<6	<50	<15.0	<15.0	<15.0	<5	NA	<6	<50	<15.0	<15.0	<15.0
Semi Volatile Compounds SW8270	(BDL•	BDL*	BDL*	See Below	BDL*	BDL•	BDL•	BDL•	BDL*	BDL*	See Below	BDL*	See Below	BDL*	BDL•	BDL•	BDL*	See Below	BDL•	See Below	BDL*
Silver	ug/l	<50	NA	<6	<50	NA	NA	NA	<\$0	NA	<6	<50	NA	NA	NA	<50	NA	<6	<50	NA	NA	NA
Sodium	mg/1	63	NA	74.2	76.5	NA	NA	NA	53		55.7	54.8	NA	NA	NA	55	NA	59.7	52.2	NA	NA	<u>NA</u>
Thallium	ug/l	<1.5	NA	<6	<12	<1.0	<1.0	<1.0	<1.5	NA	<6	<12	<0.5	<1.0	<1.0	<1.5	NA	<6	<12	<1.0	<1.0	<1.0
Vanadium	mg/1	<1	NA	<0.013	<0.10	NA	NA	NA	<1	NA	<0.013	< 0.10	NA	NA	NA	<1	NA	<0.013	<0.10	NA	NA	NA
Volatile Compounds, SW8260	(<u>ug/1</u>	BDL•	NA	See Below	BDL*	BDL*	BDL•	BDL*	BDL*	NA	See Below	See Below	BDL•	BDL*	BDL•	BDL*	<u>NA</u>	See Below	See Below	BDL•	BDL•	BDL*
Zinc	ug/l	<10	NA	<25	<200	15	<10	<10	<10	NA	<25	<200	30	<10	<10	15	NA	<25	<200	29	13	13
pH	<u>S.U.</u>	6.8	6.7	6.85	3.5	6.69	0.09	0.44	0.7	6.8	6.92	6.3	6.48	0.0	6.63	7.0	6.7	6.75	6.7	0.03	6.38	7.29
Conductivity	umbas/am	4 200	4100	13.0	13.1	10.8	10.8	1 700	13	1400	12.0	2 900	10.3	10.8	13.3	12	11	11.3	12.2	1 2 2 0	10.0	- 12
0/25/08(R) = Date in which a reservate	occurred	4,200	4,100	3,480	3,300	3,040	3,040	3,700	3,000	3,400	2,090	2,890	2,920	2,910	2,800	4,000	3,800	3,330	3,370	3,230	3,300	3,310
BDL* - Al coathants analyzed were belo NA = Not Analyzed. *** - The behicked sample from bfW-21 (The will war resampled or?///07. *** - The behicke sample behind during it dis QA/QC process. They war set **3 = MW-23 was resampled for posticide	w laboratory d S/19/97) was b be E/97 sumpli sampled on 9/1 n on Septembe	latection limits. woken during ship ng event failed 1997 and 9/22/97. ar 26, 1997.	ping.																·			
SVOC Detections				T							<u> </u>			<u>,</u>							· · · · ·	1
Benzo (g.h.i) perytene	ug/i	<12	<11	<10	<10	<5.0	<5.0	<5.0	<12	<11	<10	<10	<5.0	<5.0	<5.0	<12	<11	<10	<10	<5.0	<5.0	<5.0
bis (2-Ethylhexyl) phthalate	ug/l	<12	<11	<6.0	3.1*	<2.0	<2.0	<2.0	<12	<11	<6.0	5.2*	<2.0	2.5	<2.0	<12	<11	<6.0	3.3*	<2.0	2.2	<2.0
Dutyl henryt shthalate	ue/l	(1)	<11	<10	<10	<10	<10	250	212	(1)	210	<10	180	<1A	(10	<12	<11	<10	<10	<50	640	

ug/l	<12	<11	<6.0	3.1*	<2.0	<2.0	<2.0	<12	<11	<6.0	5.2*	<2.0	2.5	<2.0	<12	<11	<6.0	3.3*	<2.0	2.2	<2.0
ug/i	<12	<11	<10	<10	<5.0	<5.0	<\$.0	<12	<11	<10	<10	<5.0	<5.0	<5.0	<12	<11	<10	<10	<5.0	<5.0	<5.0
ug/l	<12	<11	<10	<10	<1.0	<1.0	<1.0	<12	<11	<10	<10	<1.0	<1.0	<1.0	<12	<11	<10	<10	<1.0	<1.0	<1.0
ug/l	<12	<11	<10	0.17*	<1.0	<1.0	<1.0	<12	<11	<10	<10	<1.0	<1.0	<1.0	<12	<11	<10	<10	<1.0	<1.0	<1.0
		1																			
ug/t	<0.20	<5.0	<2.5	<0.100	<0.10	<0.10	<0.10	<0.20	<5.0	<2.5	0.0730*	<0.10	<0.10	<0.10	<0.20	<5.0	<2.5	<0.200	<0.10	<0.10	<1.0
ug/l	< 0.05	NA	<0.050	<0.0500	<0.02	<0.02	<0.02	< 0.05	NA	<0.050	< 0.0500	<0.02	<0.02	<0.02	<0.05	NA	0.021*	<0.0500	<0.02	<0.02	<0.02
ug/l	< 0.05	<0.20	<0.050	<0.0500	< 0.03	<0.03	< 0.03	< 0.05	<0.20	<0.050	<0.0500	< 0.03	<0.03	<0.03	<0.05	<0.20	<0.050	<0.0500	< 0.03	<0.03	<0.03
		· · · · · · · · · · · · · · · · · · ·	t																		
ug/l	<0.10	NA	<0.94	<4.0	<0.10	<0.10	<0.10	<0.10	NA	< 0.94	<4.0	<0.10	<0.10	<0.10	<0.10	NA	< 0.94	<4.0	<0.10	<0.10	<0.10
ug/l	<10	NA	<94	<400	<10	<10	<10	<10	NA	<94	<400	<10	<10	<10	<10	NA	<94	<400	<10	<10	<10
սց/1	<100	NA	<2	<2.00	<20	<20	<20	<100	NA	<2	1.46*	<20	<20	<20	<[00]	NA	<2	1.40*	<20	<20	<20
ug/l	<5	NA	<1	<1.00	<0.5	<0.5	<0.5	<5	NA	<1	<1.00	< 0.5	<0.5	< 0.5	<5	NA	<1	<1.00	<0.5	< 0.5	<0.5
ug/l	<5	NA	1.5	<1.00	<1.0	<1.0	<1.0	<5	NA	1.3	0.470*	<1.0	<1.0	<1.0	ব	NA	4.2	0.497*	<1.0	<1.0	<1.0
ug/1	<5	NA	<1	<1.00	<1.0	<1.0	<1.0	<5	NA	<	<1.00	<1.0	<1.0	<1.0	<5	NA	<1	<1.00	<1.0	<1.0	<1.0
	ug/1 ug/1	ug/l <12 ug/l <12 ug/l <12 ug/l <12 ug/l <12 ug/l <0.05 ug/l <0.05 ug/l <0.05 ug/l <0.05 ug/l <0.05 ug/l <10 ug/l <10 ug/l <10 ug/l <10 ug/l <5 ug/l <5 ug/l <5	ug/l <12	ug/l <12	ug1 <12	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $

• = Detection result reported below laboratory EQL.

*¹ = 2.1 ug/l chlordane detected August 1997, resampled in September 1997 with 0.85 ug/l chlordane detected.

		r			MW-24				MW-24DUP				MW-25			
PARAMETER NAME	UNITS	11/20/96	2/11/97	5/20/97	8/27/97	11/18/97	2/24/98	6/22/98	11/18/97	11/19/96	2/11/97	5/20/97	8/28/97	11/19/97	2/25/98	
Aluminum	ug/l	<500	NA	<120	<1,000	NA	NA	NA	NA	<500	NA	<120	<1,000	NA	NA	
Ananonia	mg/l	0.46	0.45	<1.5	<1.5	0.47	0.46	0.43	0.41	2.2	2	<1.5	<1.5	1.49	1.34	
Antimony	ug/l	<4	<4	<6	<50	3.1	<3.0	<3.0	<3.0	<4	4	<6.0	<50	<3.0	<3.0	
Arsenic	ug/l	6.6	5.9	<u> 11</u>	<50	17	15	15	16	9.9	5.1	20	<50	30	36	
Berium	ug/i	<100	<100	6	<20	<10	10	<10	<10	<100	<100	4	<20	<10	<10	
Beryllium	ug/t	<0.5	<0.5	<1.0	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<10	< 0.5	<0.5	
Cadmium	ug/1	<1	NA	<1.0	<10	<0.5	<0.5	<0.5	< 0.5	<1	NA	<1.0	<10	<0.5	<0.5	
Calcium	mg/1	370	NA	375	411	NA	NA	NA	NA	660	NA	511	541	NA	NA -	
Chromium	ug/1	<2	\$	<13	<100	<20	<20	<20	<20	<2	<2	<13	<100	<20	<20	
Cobalt	ug/l	<100	<100	<6.0	<50	NA	NA	NA	NA	<100	<100	<6.0	<50	NA	NA	
Coppet	(l	<20	NA	<13	<100	NA	NA	NA	NA	20	NA	<13	<100	NA	NA	
Herbicides, SW8150	ug/1	BDL*	NA	BDL*	BDL**1	BDL*	BDL*	BDL*	BDL•	BDL*	NA	BDL*	BDL++1	BDL*	BDL*	
Iron	mg/l	11	NA	9.66	6.67	NA	NA	NA	NA	15	NA	14.5	16.2	NA	NA	
Lead	ug/l	<1	NA	<6.0	<\$0	<2.0	<2.0	<2.0	2.2	<2	NA	<6.0	<50	<2.0	<2.0	
Magnesium	mg/l	290	NA	315	329	NA	NA	NA	NA	500	NA	736	773	NA	NA	夏
Manganese	ug/l	190	170	158	165	NA	NA	NA	NA	120	110	61	58	NA	NA	Š I
Mercury	ug/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	3
Nickel	ug/l	83	43	<13	<100	<20	<20	<20	<20	110	68	<13	<100	<20	<20	
Nitrate/Nitrite	mg/l	0.05	<0.05	<0.20	<0.20	<0.05	< 0.05	0.08	<0.05	<0.05	<0.05	<0.20	<0.20	<0.05	<0.05	`
Perticides, SW8081	ug/l	BDL+	BDL*	BDL*	BDL*	BDL*	BDL*	BDL*	BDL*	BDL*	BDL*	BDL*	++ ³	See Below	See Below	- 1
Phosphorus, Total	mg/t	1.8	1.2	1.56	<0.020	NA	NA	NA	NA	2.1	1.7	<0.020	0.0450	NA	NA	
Potasium	mg/l	6.5	7.2	NA	6.5	NA	NA	NA	NA	12	12	NA	8.8	NA	NA	
Selenium	ug/l	<5	NA	<6.0	<50	<15.0	<15.0	<15.0	<15.0	<5	NA	<6.0	<50	<15.0	<15.0	
Semi Volatile Compounds SW8270	ug/l	BDL*	BDL*	BDL*	See Below	BDL*	BDL*	BDL•	BDL.*	BDL*	BDL*	BDL*	See Below	BDL*	BDL*	
Silver	ug/l	<\$0	NA	<6.0	<50	NA	NA	NA	NA ·	<50	NA	<6.0	<50	NA	NA	
Sodium	mg/l	56	NA	75.6	69.4	NA	NA	NA_	NA	210	NA	158	153	NA	NA	i
Thallium	ug/l	<1.5	NA	<6.0	<12	<1.0	<1.0	<1.0	<1.0	<1.5	NA	<6.0	<12	<1.0	<1.0	
Venedium	mg/1	<1	NA	< 0.013	<0.10	NA	NA	NA	NA	<1	NA	< 0.013	<0.10	NA	NA	
Volatile Compounds, SW8260	ug/l	BDL*	NA	See Below	See Below	BDL*	BDL*	BDL*	BDL*	BDL*	NA	Sec Below	See Below	BDL*	BDL*	
Zinc	ug/1	<10	NA	<25	<200	15	<10	<10	12	11	NA	<25	<200	24	<10	
рН	S.U.	6.8	6.8	6.56	7.1	6.52	6.64	6.9	6.52	6.6	6.5	6.72	6.6	6.79	6.73	
Temperature	<u>с</u>	12	11	11.1	11.7	9.7	11.1	12.9	9.7	12	12	12.7	14.2	12.1	11.8	
Conductivity	umhos/em	4,200	3,800	3,630	3,230	3,170	3,250	3,330_	3,170	6,600	6,400	5,540	5,510	5,410	5,360	

9/25/98(R) = Date in which a resample occurred.

BDL* = All constituents analyzed were below laboratory detection limits.

DU.⁺ = AI constructors analyzed wave vectors incoveratory detection inters.
 NA = NA Analyzed.
 **⁴ = The barbicide sample from MW-21 (*3/19/7*) was broken during shipping. The well was resampled on/7/87.
 **³ = The barbicide samples taken during the E97 sampling event failed

the QA/QC process. They were resampled on 9/19/97 and 9/22/97. **3 = MW-25 was resampled for pesticides on September 26, 1997.

the second s																
SVOC Detections																1
Benzo (g.h.i) perylene	ug/l	<12	<11	<10	<10	<5.0	<5.0	<5.0	<5.0	<12	<12	<10	<10	<5.0	<5.0	
bis (2-Ethylhexyl) phthalate	ug/l	<12	<11	<6.0	1.2*	<2.0	<2.0	<2.0	<2.0	<12	<12	<6.0	1.3*	<2.0	<2.0	
Butyl benzyl phthalate	ug/l	<12	<11	<10	<10	<5.0	<5.0	<5.0	<5.0	<12	<12	<10	<10	<5.0	<5.0	
Diethylphthalate	ug/l	<12	<11	<10	<10	<1.0	<1.0	<1.0	<1.0	<12	<12	<10	<10	<1.0	<1.0	1
Di-n-butylphthalate	ug/t	<12	<11	<10	0.42*	<1.0	<1.0	<1.0	<1.0	<12	<12	<10	<10	<1.0	<1.0	1
Pesticide Detections																
(Tech) Chiordane	ug/l	<0.20	<5.0	<2.5	<0.200	<0.10	<0.10	<0.10	<0.10	<0.20	<5.0	<2.5	2.1/0.85	1.3	0.18	
gamma-BHC (Lindane)	ug/l	< 0.05	NA	<0.050	<0.0500	<0.02	<0.02	<0.02	<0.02	<0.05	NA	<0.050	<0.0500	<0.02	<0.02	Į Ž
Heptachlor	ug/i	< 0.05	<0.20	<0.050	<0.0500	< 0.03	<0.03	<0.03	<0.03	<0.05	<0.20	<0.050	0.0320*	<0.03	< 0.03	Į
Herbicide Detections				T												Ā
2,4-Dichlorophenoxyacetic acid	ug/l	<0.10	NA	<0.94	<4.0	<0.10	<0.10	<0.10	<0.10	<0.10	NA	<0.94	<4.0	<0.10	<0.10	
MCPP (Mecoprop)	ug/i	<10	NA	<94	<400	<10	<10	<10	<10	<10	NA	<94	<400	<10	<10	
VOC Detections	1												11			
Acetone	ug/l	<100	NA	<2	1.74*	<20	<20	<20	<20	<100	NA	<2	<2.00	<20	<20	1
Chloroform	ug/l	<5	NA	<1	<1.00	<0.5	< 0.5	<0.5	<0.5	<5	NA	ৰ	<1.00	<0.5	<0.5	1
Methylene chloride	ug/l	<5	NA	2.5	<1.00	<1.0	<1.0	<1.0	<1.0	<5	NA	2.8	<1.00	<1.0	<1.0	1
Toluene	ug/l	<5	NA	<1	<1.00	<1.0	<1.0	<1.0	<1.0	<5	NA	<1	0.420*	<1.0	<1.0	
* = Detection result reported below la	boratory EQL.	_														

*1 = 2.1 ug/l chlordane detected August 1997, resampled in September

1997 with 0.85 ug/l chlordane detected.

	T		·····		MW-26				MW-26DUP	r			MW-27							MW-28	···		
PARAMETER NAME	UNITS	11/19/96	2/11/97	5/20/97	8/28/97	11/19/97	2/25/98		11/19/97	11/19/96	2/11/97	5/20/97	8/28/97	11/19/97	2/25/98	6/23/98	11/20/96	2/10/97	5/19/97	8/26/97	11/18/97	2/25/98	6/22/98
			<u> </u>		1				<u> </u>	1	1				1	· · · · · · · · · · · · · · · · · · ·							
Aluminum	ug/l	<500	NA	<120	<1,000	NA	NA		NA	<500	NA	<120	<1,000	NA	NA	NA	<500	NA	<120	<1,000	NA	NA	NA
Ammonia	ng/1	0.89	0.92	<1.5	<1.5	0.84	0.66	ļ	0.71	1.5	1.2	<1.5	<1.5	0.87	0.99	0.96	1.6	1.5	<1.5	<1.5	0.40	0.64	0.75
Antimony	u/1	<4	<4	<6	<50	<3.0	<3.0	1	<3.0	<4	<4	<6	<50	<3.0	<3.0	<3.0	<4	4.1	<6	<50	<3.0	<3.0	<3.0
Arsenic	ug/1	15	9.7	28	<50	36	35		36	<5	<5	<6.0	<50	4.7	6.3	7.8	<5	<5	<6	<50	<3.0	3.0	<3.0
Barium	Ug/1	<100	<100	5	<20	<10	<10		<10	120	<100	7	<20	<10	<10	<10	<100	110	<u> </u>	<20	11	<10	<10
Beryllium	Ug/1	< 0.5	<0.5	<1.0	<10	<0.5	<0.5		< 0.5	<0.5	<0.5	<1.0	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<10	<0.5	<0.5	<0.5
Cadmium	ug/1	<1	NA	<1.0	<10	<0.5	< 0.5		<0.5	<1	NA	<1.0	<10	<0.5	<0.5	<0.5	<1	NA	<1.0	<10	0.5	<0.5	<0.5
Calcium	mg/1	460	NA	490	501	NA	NA		NA	560	NA	504	534	NA	NA	NA	410	NA	406	490	NA	NA	NA
Chromium	ug/1	<2	<2	<13	<100	<20	<20		<20	<2	<2	<13	<100	<20	<20	<20	<2	<2	<13	<100	<20	<20	<20
Cobalt	ug/1	<100	<100	<6.0	<50	NA	NA		<u>NA</u>	100	<100	6	<50	NA	NA	NA	<100	<100	<6	<50	NA	NA	<u>NA</u>
Copper	ug/1	<20	NA	<13	<100	NA	NA		NA	21	NA	<13	<100	NA	NA	NA	<20	NA	<13	<100	NA	NA	NA
Herbicides, SW8150	ug/l	BDL•	NA	BDL*	BDL**1	BDL*	BDL*		BDL*	BDL*	NA	BDL*	BDL**	BDL*	BDL*	BDL*	BDL*	NA	BDL*	BDL**1	BDL*	BDL*	See Below
Iron	mg/l	10	NA	12.6	14.0	NA	NA		NA	0.12	NA	10.9	14.3	NA	NA	NA	2.1	NA	0.651	1.30	NA	NA	NA
Lead	ug/1	<2	NA	<6.0	<50	<2.0	<2.0		<2.0	<2	NA	<6.0	<50	<2.0	<2.0	<2.0	<2	NA	<6	<50	<2.0	<2.0	<2.0
Magnetium	(i	290	NA	323	320	NA	NA	E E	NA	480	NA	683	712	NA	NA	NA	190	NA	205	239	NA	NA	NA
Manganese	ug/l	160	120	135	115	NA	NA	8	NA	420	300	227	157	NA	NA	NA	220	320	400	417	NA	NA	NA
Mercury	ug/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20	<0.2	<0.2	<0.2	<0.2
Nickel	ug/l	82	44	<13	<100	<20	<20	ġ.	<20	150	74	<13	<100	<20	<20	<20	83	78	<13	<100	<20	<20	<20
Nitrate/Nitrite	mg/l	0.11	<0.05	<0.20	<0.20	<0.05	<0.05		<0.05	0.05	<0.05	<0.20	<0.20	0.06	<0.05	0.18	<0.05	<0.05	<0.40	<0.20	0.17	0.06	0.28
Pesticides, SW8081	ug/l	BDL*	BDL*	BDL*	BDL.	BDL*	BDL*		BDL*	BDL*	BDL*	BDL*	BDL*	BDL.	BDL*	BDL*	BDL*	BDL*	BDL*	BDL*	BDL*	BDL*	BDL*
Phosphorus, Total	mg/l	2.4	0.69	0.826	<0.020	NA	NA		NA	0.28	0.27	<0.020	0.146	NA	NA	NA	0.8	0.89	0.211	0.333	NA	NA	NA
Potaniium	mg/l	8.1	8	NA	7.1	NA	NA		NA	23	13	NA	. 9.4	NA	NA	NA	14	15	NA	9.1	NA	NA	NA
Selenium	ug/i	<5	NA	<6.0	<50	<15.0	<15.0		<15.0	<5	NA _	<6.0	<50	<15.0	<15.0	<15.0	<5	NA	<6	<50	<15.0	<15.0	<15.0
Semi Volatile Compounds SW8270	ug/l	BDL*	BDL*	BDL.*	See Below	BDL*	BDL*		BDL•	BDL*	BDL*	See Below	See Below	BDL*	See Below	BDL*	BDL*	BDL*	BDL*	See Below	BDL*	BDL*	BDL*
Silver	ug/1	<50	NA	<6.0	<50	NA	NA		NA	<50	NA	<6.0	<50	NA	NA	NA	<50	NA	<6	<50	NA	NA	NA
Sodium	mg/i	110	NA	96.5	82.2	NA	NA		NA	180	NA	173	161	NA	NA	NA	57	NA	73.0	87.5	NA	NA	NA
Thaltium	ug/l	<1.5	NA	<6.0	<12	<1.0	<1.0		<1.0	<1.5	NA	<6.0	<12	<1.0	<1.0	<1.0	<1.5	NA	<6	<12	<1.0	<1.0	<1.0
Vanadium	mg/l	<i< td=""><td>NA</td><td>< 0.013</td><td><0.10</td><td>NA</td><td>NA</td><td></td><td>NA</td><td><</td><td>NA</td><td><0.013</td><td><0.10</td><td>NA</td><td>NA</td><td>NA</td><td><1</td><td>NA</td><td><0.013</td><td><0.10</td><td>NA</td><td>NA</td><td>NA</td></i<>	NA	< 0.013	<0.10	NA	NA		NA	<	NA	<0.013	<0.10	NA	NA	NA	<1	NA	<0.013	<0.10	NA	NA	NA
Volatile Compounds, SW8260	ug/l	BDL*	NA	See Below	See Below	BDL*	BDL*		BDL.	BDL*	NA	See Below	BDL*	BDL*	BDL*	BDL*	BDL*	NA	See Below	See Below	BDL*	BDL*	BDL.
Zinc	ug/1	10	NA	<25	<200	<10	<10		<10	12	NA	<25	<200	24	<10	12	<10	NA	<25	<200	21	<10	<10
pH	S.U.	6.9	6.5	6.66	6.6	6.74	6.76		6.74	7.0	6.2	6.79	6.7	6.92	6.71	6.61	7.6	6.6	7.35	6.9	7.01	7.04	7.23
Temperature	÷C	12	11	12.6	14.4	11.8	12		11.8	12	11	12.8	13.8	11.3	11	13.3	11	10	11.7	11.6	9.7	11.1	12.5
Conductivity	umhos/cm	4,500	4,200	3,830	3,680	3,500	3,610		3,500	6,000	6,500	5,470	5,280	5,190	5,100	5,040	3,700	3,600	3,160	3,140	3,130	3,130	3,110
9/25/98(R) = Date in which a resample	e occurred.																						
 BDL[*] - All constituents analyzed ware below 4*³ - The hardwide analyzed. **³ - The hardwide analyzed on MW-21. **³ - The bardwide samples taken during the QA/QC process. They ware re- **³ = MW-13 was resampled for pesticide. 	ow laboratory d (5/19/97) waa bi the 8/97 samplin mampled on 9/1 au ou September	etection innits. roken during ship g event failed 9/97 and 9/22/97. r 26, 1997.	ping.																				
SVOC Delections																							
Benzo (g.h. i) perylene	ug/1	<14	<11	<10	<10	<5.0	<5.0		<5.0	<12	<u> </u>	<10	<10	<5.0	<5.0	<5.0	<14	<10	<10	<10	<5.0	<5.0	<5.0

Benzo (g.h.i) perylene	ug/l	<14	<11	<10	<10	<5.0	<5.0		<5.0	<12	<11	<10	<10	<5.0	<5.0	<5.0	<14	<10	<10	<10	<5.0	<5.0	<5.0
bis (2-Ethylhexyl) phthalate	ug/1	<14	<11	<6.0	4.9*	<2.0	<2.0		<2.0	<12	<11	8.2	2.9*	<2.0	2.0	<2.0	<14	<10	<6.0	0.98*	<2.0	<2.0	<2.0
Butyl benzyl phthalate	ug/l	<14	<11	<10	<10	<5.0	<5.0		<5.0	<12	<11	<10	<[0	<5.0	<5.0	<5.0	<14	<10	<10	<10	<5.0	<5.0	<5.0
Diethylphthalate	ug/l	<14	<11	<10	0.28*	<1.0	<1.0	ł	<1.0	<12	<11	<10	<10	<1.0	<1.0	<1.0	<14	<10	<10	0.15*	<1.0	<1.0	<1.0
Di-n-butylphthalate	ug/l	<14	<11	<10	1.0*	<1.0	<1.0		<1.0	<12	<11	<10	2.7*	<1.0	<1.0	<1.0	<14	<10	<10	1.2*	<1.0	<1.0	<1.0
Pesticide Detections																							
(Tech) Chlordane	ug/l	<0.20	<5.0	<2.5	<0.200	<0.10	<0.10	E E	<0.10	<0.20	<5.0	<2.5	<0.200	<0.10	<0.10	<0.10	<0.20	<5.0	<2.5	<0.100	<0.10	<0.10	<0.10
garrana-BHC (Lindane)	ug/l	<0.05	NA	<0.050	<0.0500	<0.02	<0.02	<u> </u>	<0.02	< 0.05	NA	<0.050	<0.0500	<0.02	<0.02	<0.02	<0.05	NA	<0.050	< 0.0500	<0.02	<0.02	<0.02
Heptachlor	ug/l	< 0.05	<0.20	<0.050	<0.0500	< 0.03	< 0.03	13	< 0.03	<0.05	<0.20	<0.050	<0.0500	< 0.03	< 0.03	< 0.03	< 0.05	< 0.20	< 0.050	<0.0500	< 0.03	< 0.03	< 0.03
Herbickle Detections								e l															
2,4-Dichlorophenoxyacetic acid	ug/1	<0.10	NA	< 0.94	<4.0	<0.10	<0.10		<0.10	<0.10	NA	< 0.94	<4.0	<0.10	<0.10	<0.10	<0.10	NA	< 0.94	<4.0	<0.10	<0.10	0.14
MCPP (Mecoprop)	ug/i	<10	NA	<94	<400	<10	<10		<10	<10	NA	<94	<400	<10	<10	<10	<10	NA	<94	<400	<10	<10	<10
VOC Detections									_							_							
Acetone	ug/l	<100	NA	<2	1.46*	<20	<20		<20	<100	NA	<2	<2.00	<20	<20	<20	<100	NA	<2	1.46*	<20	<20	<20
Chloroform	ug/l	<5	NA	<1	0.634*	<0.5	<0.5		<0.5	<5	NA	<1	<1.00	<0.5	<0.5	<0.5	<5	NA	<1	<1.00	<0.5	<0.5	<05
Methylene chloride	ug/l	<5	NA	2.5	<1.00	<1.0	<1.0		<1.0	<5	NA	2.9	<1.00	<1.0	<1.0	0.1>	<5	NA	1.0	<1.00	<1.0	<1.0	<1.0
Toluene	ug/l	<5	NA	<1	<1.00	<1.0	<1.0		<1.0	<5	NA	<1	<1.00	<1.0	<1.0	<1.0	<5	NA	0.9*	0.410*	<1.0	<1.0	<1.0
* = Detection result reported below lab	COLUMN FOL													_		_							

sw laboratory EQL

•¹ = 2.1 ug/l chlordane detected August 1997, resampled in September 1997 with 0.85 ug/l chlordane detected.

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					MW-29							0C-WM							16-WM			
PARAMETER NAME	UNITS	11/20/96	2/10/97	520/97	8/27/97	11/18/97	2/25/98	6/23/98	11/20/96	2/11/97	520/97	\$26.97	11/19/97	2/26/98	6/23/96	11/20/96	2/11/97	5/20/97	E/26/97	11/19/97	2/26/98	86/62/9
A huminater	Ven	0052	×7	0612	<1.000	NA	V N	¥72	<100	472	<120	1 000	VN.	VN.	VV.	005>	NA NA	<120		VN.	¥7	¥7
Arrmonia	Valle Valle	10	0.69	ŝ	¢.5	0.10	0.15	<0.05	01	0.97	ŝ	<u>د</u> اء	0.92	0.98	0.90	0.57	0.46	<u>5</u> .5	<u>6</u> 15	0.22	0.28	0.32
Antimony	1/8m	6.1	₽	\$	8 8	43	<1.0	410	3	-	\$	ş	<3.0	<3.0	<10	1.1	₹	\$	°50	3.2	<3.0	9 .0
Artenic	∕₿n	\$	ŋ	€.0	<50	<3.0	<3.0	<3.0	13	1	17	<50	22	61	22	\$	Ş	<6.0	<50	<3.0	<3.0	<3.0
Barium	l'an	130	<100 <100	=	8	=	01⊳	<10	<100	100 ∧1	-	6	<10	<10	<10	001>	00 ∨	10	0 7⊽	=	<10	0 ⊽
Beryllium	Man	<0.5	<0.5	<1.0	¢10	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0 <	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<10	<0.5	<0.5	<0.5
Cedmium	Man	₹	VN	<1.0	012	<0.5	<0.5	<0.5	4	ž	0.1>	0]v	<0.5	<0.5	<u>6</u> 5	Þ	Y	0.15	01⊳	<0.5	<0.5	<0.5
Calcium	- Mar	210	٧N	415	429	¥¥	NA N	٧X	360	YN	366	476	٧N	NA	V N	510	VN	505	536	NA	VN	YZ
Chromium	1/Sm	4	۵	÷	00	20 20	<20	<20	\$	\$	<13	<100	<20	<20	<20	5	\$	<13	001⊳	<20	<20	<20
Cobalt	Vân	<100	<100	1	<50	YN	VN	YN	<100	001∨	<6.0	<\$0	٩N	٨N	NA	<100	<100	<6.0	\$S	NA	NA	VN
Copper	Van	<20	VN	€)	001≥	VN	VN	VN	<20	Y	()>	001>	¥N.	VN	NA	<20	VN	<13	001>	NA	٧N	ž
Harbicides, SW8150	l/au	BDL	٩N	•JO8	BDL	BDL.	BDL	•108	BDL.	VN	BDL.	BDL**	BDL [•]	BDL.	BDL*	BDL.	¥N.	BDL*	BDL**	BDL.	BDL.	BDL*
Iron	-	0.034	۸N	0.216	<0.50	VN	٧N	VN	10	ž	9:11	12.0	VN	YN	NA	0.17	٩N	2.04	42	YN	ž	YN
Lead	- Man	4	٧N	<0.9>	\$ \$	<2.0	20	<2.0	4	ž	<0.0>	9 ₹	<2.0	610	ก	\$	AN	6.0	\$0	<2.0	<2.0	5
Megnesium	N	8	YN.	261	265	N A	Ŵ	VN	081	ž	221	286	٧N	ž	NA	8	AN	196	206	VN	AN	Y
Manganese	₩ Man	710	1,200	1,010	808	¥Z	VN	YN	79	28	62	76	VN	VN	VN	350	330	358	378	VN	VN	AN
Mercury	- An	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nickel	1	78	901	29	00 ?⊽	9	23	33	89	<40	<13	00	<20	<20	<20	91	40	<13	<100	<20	<20	21
Nitrate/Nitrite	J an	0.07	0.11	0.297	<0.20	9.17	0.12	0.35	<0.05	<0.05	<0.20	<0.20	<0.05	<0.05	0.07	<0.05	0.06	<0.20	<0.20	<0.05	0.06	0.05
Penticides, SW8081	¶an ∣	BDL.	BDL	BDL•	BDL	BDL•	BDL*	•108	BDL•	BDL.	BDL*	BDL*	BDL•	BDL*	BDL.	BDL*	BDL.	BDL.	BDL*	BDL*	BDL•	BDL*
Phosphorus, Total	₩ Me	0.0	1.4	0.475	<0.020	NA	V N	VN	4.1	0.7	0.256	<0.020	VN	NA	NA	0.66	0.21	0.713	<0.020	AN	AN	NA
Potassium	1/BLL	22	16	¥	9.0	¥	V N	YN	6.2	8.2	VN	6.4	VN	YN	NA	=	=	VN	7.2	VN	V N	YN
Selenium	∕8n	2	VN	<6.0	\$	<15.0	<15.0	<15.0	₽	¥	<6.0	\$0	<15.0	<15.0	<15.0	₽	VN	<6.0	\$0 \$	<15.0	<15.0	<15.0
Semi Volatile Compounds SW8270	l/8n	BDL*	BDL.	BDL•	See Below	BDL.	See Below	BDL	BDL.	BDL*	BDL* S	ee Below	BDL	See Below	BDL•	BDL*	BDL•	BDL [•] S	ee Below	BDL.	ice Below	BDL [•]
Silver	l∕8n	<50	VN	<6.0	<50	VN	٩N	VN	<50	VN	<6.0	<30	VN	VN	NA	<50	NA	€0	\$0	¥	ž	٧X
Sodium	mg/l	25	VN	57.0	64.6	VN	٧N	VN	45	٩N	58.0	66.6	٧N	٩X	NA	26	٧N	29.0	28.3	¥	¥	X
Thatlium	yan	5,1S	VN	<6.0 <	<12	<1.0	0.1>	<1.0	<1.5	NA	<6.0	<12	0.1>	<1.0	<1.0	<1.5	AN	<6.0	<12	<1.0	<1.0	<1.0 <1
Vanadium	mg/l	Þ	VN	<0.013	<0.10	٧N	NA	VN	Þ	NA	<0.013	<0.10	VN	NA	NA	Þ	NA	<0.013	<0.10	VN	AN	NA
Volatile Compounds, SW8260	∕8n	BDL.	٧N	See Below	See Below	BDL*	BDL.	VN	BDL*	NA 1	See Below S	ee Below	BDL*	BDL	BDL ⁴	BDL*	NA NA	See Below S	Gee Below	BDL.	BDL•	BDL*
Ziane	V 8π	01>	٧N	<25	<200	59	22	Ξ	<10	VN	<u>ک</u> ک	<200	23	<10	<10	<10	VN	<25	<200	<10	01⊳	<10
Hq	S.U.	6.9	6.7	6.31	1.2	6.80	6.98	6.96	6.5	6.8	6.90	6.6	7.05	6.84	6.62	6.5	6.7	6.70	6.7	6.67	6.71	6.56
Temperature	ပ္	11	0	13.1	11.6	9.7	11.5	12.9	2	0	11.1	13.2	10.7	10.4	11.7	2	0	1.11	12.5	10.8	=	51
Conductivity	umhos/cm	1,200	3,800	3,320	3,210	3,230	3,360	3,280	3,200	3,300	3.030	2,930	2,960	2.900	2,990	4,000	3,500	3.070	3,040	3,030	2,990	2,980
9/25/98(R) = Date in which a resemple	occurred																					
BDL° = All constituents analyzed ware balos	w laboratory de	stection limits.																				

 A.D. The relativistic marginum environment of an environment and a big disping.
 A. Reidelich analysis from *RV*(31 (0.1997) was brocken daring shipping.
 The well was researched control??
 A.D. Analysis taka analysis was researched an 919397 and 20207.
 B. A.Q.A.C. process. They was researched on 919397 and 20207.
 S. M.W.23 was researched for pendicides on Stephender 26, 1997. -- www.200

SVOC Detections					I											[-					
Berzo (g.h.i) parylane	/an	61>	11>	01>	<10	<5.0	<\$.0	<5.0	<12	41	<10	01≻	<5.0	<5.0	<5.0	<12	11>	<10	0.12*	<3.0	<5.0	<3.0
bis (2-Ethythexyt) phthalate	/ 8n	<[]	Ð	<6.0	2.5*	<2.0	4.4	<1.0	<12	Â	<6.0	1.4*	<2.0	24	<2.0	412	Ð	<6.0	0.51*	20	3.8	0 7
Butyl benzyl phthalate	1/an	61>	IIV	<10	01>	≤3.0	<5.0	<5.0	<12	ŝ	01>	0.044*	<5.0	<3.0	<3.0	<12	ī	<10	<10	<5.0	<5.0	<\$.0
Diethykphthalate	l'an	61>	1₽	012	<10	<1.0	<1.0	41.0	<12	411	01>	<10	0.12	<1.0	<1.0	<12	I₹	<10	<10	0.15	<1.0 <1.0	0.i∧
Di-n-butylphthalate	l∕9n	<13	II>	01>	<10	0'1>	<1.0	<1.0	<12	<11>	<10	0.75*	<1.0	<1.0	<1.0	<12	411	<10	0.35*	<1.0	<1.0	<1.0
Pesticide Detections																						
(Tech) Chlordane	∕8n	<0.20	<5.0	2.5	<0.200	<0.10	<0.10	<0.10	<0.20	<5.0	<2.5	<0.100	<0.10	<0.10	<0.10	<0.20	<5.0	<2.5	<0.100	<0.10	<0.10	<0.10
gentua-BHC (Lindane)	1/8n	<0.05	¥	<0.050	<0.0500	<0.02	<0.02	<0.02	<0.05	٧N	<0.050	<0.0500	<0.02	<0.02	<0.02	<0.05	YN	<0.050	<0.0500	<0.02	<0.02	<0.02
Heptachlor	l∕8u	<0.05	<0.20	<0.050	<0.0500	<0.03	<0.03	<0.03	<0.05	<0.20	<0.050	<0.0500	<0.03	<0.03	<0.03	<0.05	<0.20	<0.050	<0.0500	<0.03	<0.03	<0.03
Herbicide Detections																			-			
2,4-Dichlorophenoxyacetic acid	∕8n	<0.10	٧N	<0.94	<4.0	<0.10	<0.10	<0.10	<0.10	VN	<0.94	<4.0	<0.10	<0.10	<0.10	<0.10	NN	<0.94	<4.0	<0.10	<0.10	<0.10
MCPP (Mecoprop)	∕8n	<10	VN	۶¢	<400	<10	<10	<10	<10	VN	<94	<400	<10	<10	<10	<10	NA	<94	<400	<10	<10	<10
VOC Detections																-						
Acetone	√8 ⊓	<100	VN	¢	<2.00	<20	<20	<20	<100	VN	<2	1.77•	<20	<20	<20	<100	NA	⊲	5.67	<20	<20	<20
Chloroform	l∕8n	\$	V N	₽	<1.00	<0.5	<0.5	<0.5	\$	VN	V	<1.00	<0.5	<0.5	<0.5	\$	VN	⊽	<1.00	<0.5	<0.5	<0.5
Methylene chloride	∕8n	v	¥2	1.7	0.745*	0.1	<1.0 <1	<1.0	\$	VN	1.1	0.557*	<1.0	<1.0	<1.0	Ş	NA	1.2	0.501	<1.0	<1.0	<1.0 <1.0
Tolucine	l∕8⊓	₽	VN	41	<1.00	<1.0	<1.0	<1.0	\$	٧N	₽	<1.00	<1.0	<1.0	<1.0	Ş	٧N		0.470*	<1.0	1.0	<1.0
* = Detection result reported below labo	OTTON EQL																			:		
$o^{1} = 2.1$ ug/l chlordane detectod August	1997, ream	pled in Septemb	ta ta																			
1997 with 0.85 ug/l chlordane date	otted																					

					U MM						and the w						11 A.A.A.			ſ
PARAMETER NAME	UNITS	11/20/96	2/10/97	5/9/97	18/20	11/18/97	2/24/98	6/179	11/20/96	2/10/97	19/9/2	8/27/97	6/22/98	11/20/96	2/10/97	5/19/97	627/97	11/18/97	2/24/98	6/11/98
Aburninum	l'an	< 500	¥Z	<120	<1.000	Ň	¥	٩N	<300	V N	<120	000.1>	¥N.	<500	¥N.	<120	000 ⁻ 1>	Ň	¥X	YZ
Arrenonia		890	0.70	5	515	0.72	150	0.75	11	80	1		070	00	0.81	1	1	01.0	0.77	20
Artimote	/211	1		; v	5	012	30	410	3	3 3	; \$	5	410			; v	2	012	1012	5
Anenic			. =	2	8	1	9	20	, <u>×</u>	; =	2	, 9	, ,	2 2		?=	, ,	20	27	3 =
Burkum		100	1001	•	000	01>	<10	012	015	v100	-	8	1012	e lo	8	-	8	912	1	1
Berylium	5	<0.5	<u>\$</u> 05	012	0I>	<0.5	2 <u>0</u> 5	<05	<0.5	<05 205	0.15	015	<0>	\$05	<0.5 2.05	410	9₽	205	\$0 5	\$02
Cadmium	l'an	~	YN	0.1⊳	0[V	<0.5	2.0> 2.0	<0.5	₽	VN	0	9₽	<0.5	Þ	ž	015	9	<u>\$05</u>	<0>	<0 S
Calcium	2	300	YN.	285	328	VN	¥	٧N	300	Y	285	272	¥	2	¥	381	367	M	X	ž
Chromium	N	5	4	}</td <td>001∨</td> <td><20</td> <td>ŝ</td> <td><20</td> <td>4</td> <td>4</td> <td>€Ì\$</td> <td>001⊽</td> <td>97 7</td> <td>2</td> <td>4</td> <td>ŝ</td> <td>8 7</td> <td><20</td> <td>ş</td> <td>02¢</td>	001∨	<20	ŝ	<20	4	4	€Ì\$	001⊽	97 7	2	4	ŝ	8 7	<20	ş	0 2¢
Cobalt	l/an	001⊽	100	\$	<50	VN	VN	VN	001⊽	001×	\$	8	٧N	001>	0 01⊽	\$	8	٧X	¥.	ž
Copper	1 Min	<20	AN	6 15	¢ 100	VN	¥2	YN	<20	V N	€₽	001⊽	¥N.	62	¥	El>`	8 7	Y.	¥	ž
Harbicides, SW8150	, jen	BDL*	Ň	BDL.	BDL ••?	BDL.	•JO8	BDL*	BDL•	Ŵ	BDL.	BDL**	BDL*	BDL.	ž	BDL*	BDL**	BDL.	BDL.	BDL.
tron	N	50	¥	7.12	7.83	VN	¥N.	¥	14	M	6.74	5.3	ž	89	ž	6.52	6.31	V N	VN	¥Z
Lend	\an	5	YN	\$	\$S 50	2.5	<2.0	50	\$	¥	\$	\$ \$	<2.0	\$	ž	\$	\$	<2.0	<2.0	<2.0
Magnesium	₩.	140	VN	147	153	VN	NA	YN.	140	VN	146	105	X	150	٧N	189	191	٧X	¥Z	ž
Manganese	1 /8 n	120	83	53	53	VN	VN	YN	140	2	53	67	YN	110	140	69	5	VN	٧X	ž
Mercury	¶¶.	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20	<0.2	<0.2	<0.2	<0.2	<0.20	<0.2	<0.2	<0.2	<0.2
Nickel	¶¶n	65	ę	<13	001≻	<20	<20	<20	62	52	<13	001>	<20	71	60	¢ >	00I>	<20	50	0℃
Nitrate/Nitrite	ue/	<0.05	<0.05	<0.40	<0.20	0.06	<0.05	0.15	<0.05	<0.05	<0.40	<0.20	0.20	<0.05	<0.05	<0.40	<0.20	<0.05	<0.05	0.13
Pesticides, SW8081	1/din	BDL*	BDL.	BDL.	BDL ⁶	BDL*	•JOB	BDL [•]	BDL.	BDL•	•108	BDL [*]	BDL•	BDL*	BDL.	BDL•	BDL	BDL•	BDL•	BDL•
Phosphorus, Total	hen l	1.7	0.98	0.900	<0.020	YN	V N	V N	16.0	0.83	0.581	<0.020	¥Z	1.7	0.98	0.907	<0.020	VN	¥	¥
Potessium	me/	5.7	5.8	VN	<5.0	VN	AN	VN	\$	5.8	NA	<3.0	Ň	5.5	6.2	¥	<5.0	VN	N N	M
Selenium	l∕ 8 n	₽	VN	9 2	<50	<15.0	<15.0	<3.0	\$	NA	<6	<50	<15.0	\$	AN	\$	<50	<15.0	<15.0	<15.0
Semi Volatile Compounds SW8270	∕an	BDL.	•JOB	BDL.	See Below	BDL•	See Below	BDL.	BDL*	•JOB	BDL.	See Below	BDL*	BDL•	BDL•	BDL*	See Below	BDL*	See Below	BDL.
Silver	Van	\$\$¢	Ň	\$	\$	Y	ž	M	<50	Y	\$	Ş	YN	650	Y	\$	\$	ž	ž	¥z
Sodium	₩¢/	45	٩N	49.1	48.0	٧N	٩N	¥Z	46	¥Z	48.4	5.76	٧N	\$	VN	515	45.8	ž	¥	ž
Thallium	- An	415	ž	€.0	Ş	<1.0	•₽	0 . ∧	<15	¥	\$	ŝ	0.1>	515	٧N	\$	ŝ	0.1>	0 .1∧	0.1
Vanadium	Se l	Ţ	M	<0.013	<0.10	٧X	Y.	¥	₹	ž	<0.013	0 10 ≺0	¥	7	ž	<0.013	<0.10	٧N	¥	ž
Volatile Compounds, SW8260	Su .	BDL•	ž	See Below	See Below	BDL	BD		BDL*	ž	See Below	See Below	¥	BDL•	Y.	See Below	See Below	BDL•	-JGB	BDL•
Zunc neH		10	VZ V	2 3			₽	01	4	V V	63	200 7	0	_;	VN S	83	8	2 5	0	÷
Temesture	į		20	5	125	11.6	9.5	11	=	2		52		2	, «	10.7	: 2	011		
Conductivity	urrhos/cm	2.500	2.600	2.320	2,500	2.290	2300	2,280	2.500	2.600	2320	2,500	2.280	1,000	3.200	2.930	2.340	2410	2.650	2 750
9/25/98(R) = Date in which a resemple	occurred													2001-		2014	2474		2224	
BDL* = All constituents melyzed were beio	w laboratory di	fection funks.																		
Prof For Analyzed. *** - The hetbicide sample from MW-21 ()	3/19/97) www.be	oken during shippi	.2																	
The well was resampled on 77.97.	te Eritt annulle	a count fulled																		
the QA/QC process. They were rea	11/6 up pelduar	. TRALEN PAR TRI																		
**3 = NW-25 was resampled for pesticides	a on September	. 1661 1997.									•									
SVOC Delections				ſ	ſ							ľ							ľ	ſ
Benzo (g.h.i) paylene	l∕₿n	<12	₽	<10	<10	<3.0	<5.0	<3.0	<12	1Þ	<10	01>	<5.0	<12	t P	012	40	\$	<3.0	\$0
bis (2-Ethylhexyl) phthalate	N,	2 ₽	₽	9 <u>9</u>	0.76	20		5 0	5	₽	9	32	2 0	;₽	₽	9 9	0.84*	20	53	5 0
Dutyi odazyi printine Distindahahalare			₹₹		9					73			0	;	₹₹	2	9	0		
Di-n-butvibithalate		<12	; ,	012	0.32*	410	010		?<br ?</td <td>÷</td> <td>10</td> <td>065</td> <td></td> <td>;;;</td> <td>1₹</td> <td>9</td> <td>0.280</td> <td></td> <td></td> <td></td>	÷	10	065		;;;	1₹	9	0.280			
Pesticide Detections																			T	
(Tech) Chlordane	∕8⊓	<0.20	<5.0	<2.5	<0.200	<0.10	<0.10	<0.10	<0.20	<\$.0	25	<0.200	0.1>	<0.20	<5.0	23	<0.200	<0.10	01:0>	0.1>
gamma-BHC (Lindane)	l a n	<0.05	VN	<0.050	<0.0500	<0.02	<0.02	<0.02	<0.05	V N	<0.050	<0.0500	<0.02	<0.05	VN	<0.050	<0.0500	<0.02	<0.02	<0.02
Heptachlor	l∕8⊓	<0.05	<0.20	<0.050	<0.0500	<0.03	<0.03	<0.03	<0.05	<0.20	<0.050	<0.0500	<0.03	<0.05	<0.20	<0.050	<0.0500	<0.03	<0.03	<0.05
Herbidde Detections	-		;			4.4														
2,4-Uichiorophonoxyacetic acid		010	ž	s, a	0.02			0.0	01.0	¥ 7	S. S.	4.0	010		×.	X 0	4.0	0.0	010	
VOC Detections			Ţ	Ţ		ſ	Ţ	Ţ		t	ŗ		十	Ţ	t	ŗ		*	ŗ	Ţ
		10017				047		-			-	-	+		+	-		ļ		

 Acctone
 ug/i
 <100</th>
 Ni

 Chloroform
 ug/i
 <3</td>
 Ni

 MetaPriver chloride
 ug/i
 <3</td>
 Ni

 Dubare
 ug/i
 <5</td>
 Ni

 Dubare
 ug/i
 <5</td>
 Ni

 Dubare
 ug/i
 <5</td>
 Ni

 * = Description result reported below laboratory by
 <5</td>
 Ni

 * = 21 ug/i chlordane detected August 1997, resampled in Sptember
 1997, resampled in Sptember

5 of 7

60/61/6

<20 <0.5 <1.0 <1.0

<20</pre><20</pre><20</pre><1.0</pre>

<20 <0.5 <1.0 <1.0

<2.00 <1.00 0.884* <1.00</pre>

0 **0 0**

NN NN NN

\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$

<2.00
 <2.00
 <2.00
 <0.5
 <1.00
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 <1.00
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⊽⊽5 75

N N N N

<20
 <20
 <20
 <0.5
 <1.0
 <1.0
 <1.0

1.75* <20 <1.00 <0.3 1.06 <1.0 <1.0 <1.0

7 10 7

z z z z

40.0

					N	AW-34				M	W-35	MV	V-36		MW-J	7	MW-J7DUP	MV	V-38	MW-38DUP
PARAMETER NAME	UNITS	11/20/96	2/10/97	5/19/97	8/27/97	11/18/97	2/24/98	6/22/98	9/25/98(R)	2/26/98	6/23/98	1/26/98	6/23/98	2/24/98	6/22/98	9/25/98(R)	2/24/98	2/25/98	6/23/98	6/23/98
	T																			
Aluminum	ug/i	<500	NA	164	<1,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ammonia		0.8	0.88	<1.5	<1.5	0.74	0.55	0.84	NA	0.11	< 0.05	1.36	1.38	0.84	0.78	NA	0.85	<0.05	<0.05	<0.05
Antimony	ug/l	4.2	6.8	<6	<50	<3.0	<3.0	<3.0	NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	NA	<3.0	<3.0	<3.0	<3.0
Amenic	ug/t	9.2	9.1	10	<50	18	13	13	NA	3.2	<3.0	20	. 14	25	23	NA	25	<3.0	<3.0	<3.0
Barium	ur/1	<100	<100	12	<20	<10	<10	<10	NA	24	21	18	19	<10	<10	NA	<10	<u> </u>	16	16
Beryllium	ug/l	<0.5	<0.5	<1.0	<10	<0.5	<0.5	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA	<0.5	<0.5	<0.5	<0.5
Cedmium	ug/1	<1	NA	<1.0	<10	<0.5	<0.5	<0.5	NA	< 0.5	<0.5	< 0.5	<0.5	<0.5	<0.5	NA	< 0.5	<0.5	<0.5	<0.5
Calcium	mg/l	310	NA	239	285	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<u>NA</u>
Chromium	<u>ug/l</u>	<2	<2	<13	<100	<20	<20	<20	NA	<20	<20	<20	<20	<20	<20	NA	<20	<20	<20	<20
Cobalt	ug/1	<100	<100_	<6	<50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	ug/t	<20	NA	<13	<100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Herbicides, SW8150	ug/l	. BDL•	<u>NA</u>	BDL*	BDL***	BDL*	BDL*	See Below	BDL•	BDL*	BDL*	BDL*	BDL*	BDL*	See Below	BDL*	BDL•	BDL*	BDL*	BDL*
lron	n/1	3.4	NA	6.27	5.37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	ug/t	<2	NA	<6	<50	2.8	<2.0	<2.0	NA	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<u>NA</u>	<2.0	<2.0	<2.0	<2.0
Magnesium	mg/1	110	NA	104	109	NA	NA	<u>NA</u>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		230	120	65	76	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	ug/t	<0.2	<0.2	<0.20	<0.2	2.2	<0.2	<0.2	NA	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NA	<0.2	<0.2	<0.2	<0.2
Nickel	ug/l	61	45	<13	<100	<20	<20	<20	NA	29	<20	<20	<20	<20	<20	NA	<20	<20	<20	<20
Nitrate/Nitrite	mg/l	0.05	< 0.05	<0.40	< 0.20	<0.05	<0.05	0.17	NA	1.46	2.05	<0.05	<0.05	<0.05	0.13	NA	<0.05	34.0	32.0	30.5
Pesticides, SW8081	/1	BDL*	BDL*	BDL*	BDL*	BDL•	BDL*	BDL*	NA	BDL*	BDL*	BDL*	BDL*	BDL*	BDL*	NA	BDL*	BDL*	BDL*	BDL*
Phosphorus, Total	mg/l	1.8	1.8	<0.020	0.333	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potanium	mg/1	7.4	5	NA	<5.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Setenium	ug/l	<5	NA	<6	<50	<15.0	<15.0	<3.0	NA	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	NA	<15.0	<15.0	<3.0	<3.0
Semi Volatile Compounds SW8270	ug/l	BDL*	BDL*	BDL*	See Below	BDL*	BDL*	BDL*	NA	BDL*	See Below	BDL*	BDL*	BDL*	BDL*	NA	BDL*	See Below	BDL*	BDL*
Silver	ug/l	<50	NA	<6	<50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	m_/1	50	NA	39.0	39.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	ug/l	<1.5	NA	<6	<12	<1.0	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.0
Venadium	mg/l	<1	NA NA	<0.013	<0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Volatile Compounds, SW8260	ug/1	BDL•	NA	See Below	See Below	BDL*	BDL*	BDL*	NA	BDL*	BDL*	BDL*	BDL*	BDL*	BDL*	NA	BDL*	BDL.	BDL	BDL
Zinc	ug/l	<10	NA	<25	<200	19	<10	<10	NA	<10	<10	<10	<10	<10	<10	NA	<10	<10	<10	<10
рН	S.U .	7.0	5.6	6.93	7.3	7.06	6.71	7.09	NA	6.71	6.73	6.92	7.5	6.8	7.17	NA	6.82	6.94	6.84	6.84
Temperature	C	<u> </u>	7	12.5	12.7	12.2	9.7	11.4	NA	10.3	11.2	10.7	11.6	9.2	11.9	NA	9.1	10.7	12.3	12.3
Conductivity	umhon/am	2,800	2,300	1,927	1,933	2,070	2,020	1,917	NA	2,130	2,230	3,050	2,830	3,130	2,570	NA	3,130	1,549	1,638	1,638
9/25/98(R) = Date in which a resample	occurred.																			

³¹² J'76(x) - Date in which is retaining to occurred.
 ³¹² J'76(x) - Date in which is related by the boost of the section limits.
 ³⁴³ - Not Analyzed.
 ³⁴⁴ - The barbicide sample from MW-21 (51997) was broken during shipping. The twee line may example do or 77.07.
 ⁴⁴³ - The barbicide samples taken during the 597 sampling event fulled.

the QA/QC process. They were reampled on 9/19/97 and 9/12/97. **3 - MW-25 was resampled for pesticides on September 26, 1997.

	the second s			And the second se																
SVOC Detections																				
Benzo (g.h.i) perylene	ug/1	<11	<11	<10	<10	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<\$.0	<5.0	<5.0
bis (2-Ethylhexyl) phthalate	ug/1	<11	<11	<6.0	0.46*	<2.0	<2.0	<2.0	NA	<2.0	<2.0	<2.0	<2.0	4.5	<2.0	NA	<2.0	4.5	<2.0	<2.0
Butyl benzyl phthalate	ug/l	<11	<11	<10	<10	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0
Diethylphthalate	ug/l	<11	<11	<10	<10	<1.0	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.0
Di-n-butylphthalate	ug/l	<11	<11	<10	<10	<1.0	<1.0	<1.0	NA	<1.0	1.5	<1.0	<1.0	<1.0	<1.0	NĂ	<1.0	<1.0	<1.0	<1.0
Pesticide Detections																				
(Tech) Chlordane	ug/l	<0.20	<5.0	<2.5	<0.200	<0.10	<0.10	<0.10	NA	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	NA	<0.10	<0.10	<0.10	<0.10
gamma-BHC (Lindane)	ug/t	<0.05	NA _	< 0.050	<0.0500	<0.02	<0.02	<0.02	NA	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	NA	<0.02	<0.02	<0.02	<0.02
Heptachlor	ug/l	< 0.05	<0.20	<0.050	<0.0500	< 0.03	< 0.03	< 0.03	NA	<0.03	<0.03	< 0.03	<0.03	< 0.03	<0.03	NA	< 0.03	<0.03	<0.03	<0.03
Herbickle Detections																				
2,4-Dichlorophenoxyacetic acid	ug/l	<0.10	NA	< 0.94	<4.0	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.12	<0.10	<0.10	<0.10	<0.10	<0.10
MCPP (Mecoprop)	ug/1	<10	NA	<94	<400	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
VOC Detections			_																	
Acetone	ug/l	<100	NA	<2	<2.00	<20	<20	<20	NA	<20	<20	<20	<20	<20	<20	NA	<20	<20	<20	<20
Chloroform	ug/l	<5	NA	<1	0.412*	<0.5	<0.5	<0.5	NA	<0.5	<0.5	<0.5	<0.5	< 0.5	<0.5	NA	<0.5	<0.5	<0.5	<0.5
Methylene chloride	աց/լ	<5	NA	3.9	0.570*	<1.0	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.0
Toluene	ug/l	<5	NA	<1	<1.00	<1.0	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NA	<1.0	<1.0	<1.0	<1.0

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* = Detection result reported below laboratory EQL.

 $^{+1}$ = 2.1 ug/l chlordane detected August 1997, resumpled in September

1997 with 0.85 ug/l chlordane detected

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	1	M	V-39		MW-40)	N	W-41	MW-42
PARAMETER NAME	UNITS	2/25/98	6/24/98	2/25/98	6/23/98	9/25/98(R)	6/24/98	9/25/98(R)	6/24/98
									I
Aluminum	ug/1	NA	NA	NA	NA	NA	NA	NA	NA
Ammonia	mg/l	0.84	0.71	0.13	0.22	NA	1.64	NA	1.16
Antimony	ug/1	<3.0	<3.0	<3.0	<3.0	NA	<3.0	NA	3.2
Amenic	ug/1	14	10	<3.0	<3.0	NA	14	NA	6.8
Berium	(1	<10	<10	58	38	NA	27	NA	23
Beryllium	ug/1	<0.5	< 0.5	<0.5	<0.5	NA	<0.5	NA	<0.5
Cadmium	ug/i	< 0.5	<0.5	< 0.5	0.5	NA	<0.5	NA	<0.5
Calcium	mg/l	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	ug/l	<20	<20	<20	<20	NA	<20	NA	<20
Cobalt	ug/l	NA	NA	NA	NA	NA	NA	NA	NA
Copper	ug/i	NA	NA	NA	NA	NA	NA	NA	NĂ
Herbicides, SW8150	ug/1	BDL*	BDL*	BDL*	See Below	BDL*	See Below	BDL*	BDL*
Iron	mg/l	NA	NA	NA	NA	NA	NA	NA	NA
Lesd	ug/l	<2.0	<2.0	<2.0	<2.0	NA	<2.0	NA	2.9
Magnesium	mg/i	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	ug/l	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	ug/l	<0.2	<0.2	<0.2	<0.2	NA	<0.2	NA	<0.2
Nickel	ug/1	<20	<20	37	<20	NA	<20	NA	35
Nitrate/Nitrite	mg/l	<0.05	0.08	0.53	1.29	NA	0.07	NA	0.07
Pesticides, SW8081	ug/l	BDL*	BDL*	BDL*	BDL*	NA	See Below	BDL*	BDL*
Phosphorus, Total	mg/1	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	mg/l	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	ug/ł	<15.0	<15.0	<15.0	<15.0	NA	<15.0	NA	<15.0
Semi Volatile Compounds SW8270	ug/l	See Below	See Below	See Below	See Below	NA	BDL*	NA	See Below
Silver	ug/l	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	mg/l	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	ug/l	<1.0	<1.0	<1.0	<1.0	NA	<1.0	NA	<1.0
Vanadium	mg/l	NA	NA	NA	NA	NA	NA	NA	NA
Volatile Compounds, SW8260	ug/l	BDL*	BDL*	BDL*	BDL*	NA	BDL*	NA	BDL*
Zinc	ug/l	<10	<10	<10	12	NA	<10	NA	27
рН	\$.U.	6.85	6.61	6.53	6.59	NA	6.74	NA	6.86
Temperature	°C	11.3	13.1	8.9	13.3	NA	15.1	NA	15.2
Conductivity	umhos/cm	3,250	3,360	2,880	2,820	NA	2,820	NA	3,310

BDL* - All constituents analyzed ware below laboratory detection limits.

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MA = NA (Analyzed, **³ = The herbicide semple from MW-21 (*31997*) was broken during shipping. The well was resempled on *1787*.
 **² = The herbicide sempled on *1787*.

the QA/QC process. They were resampled on 9/19/97 and 9/12/97. **3 - MW-25 was resampled for pesticides on September 26, 1997.

SVOC Detections	T	r					1		T
Benzo (g.h.i) perylene	ug/l	<5.0	<5.0	<5.0	<5.0	NA	<5.0	NA	<5.0
bis (2-Ethylhexyl) phthalate	ug/l	6.8	3.0	3.4	13	NA	<2.0	NA	2.5
Butyl benzyl phthalate	ug/1	<5.0	<\$.0	<5.0	<5.0	NA	<5.0	NA	<5.0
Diethylphthalate	ug/i	<1.0	<1.0	<1.0	<1.0	NA	<1.0	NA	<1.0
Di-n-butylphthalate	ug/l	<1.0	<1.0	<1.0	<1.0	NA	<1.0	NA	<1.0
Pesticide Detections									
(Tech) Chlordane	ug/l	<0.10	<0.10	<0.10	<0.10	NA	0.87	<0.10	<0.10
gamma-BHC (Lindane)	ug/l	<0.02	<0.02	<0.02	<0.02	NA	<0.02	<0.02	<0.02
Heptachior	ug/l	<0.03	< 0.03	< 0.03	<0.03	NA	<0.03	<0.03	< 0.03
Herbicide Detections									
2,4-Dichlorophenoxyacetic acid	ug/l	<0.10	<0.10	<0.10	<0.10	<0.10	0.28	<0.10	<0.10
MCPP (Mecoprop)	ug/l	<10	<10	<10	37	<10	<10	<10	<10
VOC Detections									
Acetone	ug/l	<20	<20	<20	<20	NA	<20	NA	<20
Chloroform	ug/l	<0.5	< 0.5	< 0.5	<0.5	NA	<0.5	NA	<0.5
Methylene chloride	ug/l	<1.0	<1.0	<1.0	<1.0	NA	<1.0	NA	<1.0
Toluene	ug/l	<1.0	<1.0	<1.0	<1.0	NA	<1.0	NA	<1.0

* = Detection result reported below laboratory EQL.

*1 = 2.1 ug/l chlordane detected August 1997, resampled in September

1997 with 0.85 ug/l chlordane detected.

	Soil 1	Soil 2	Soil 3	Soil 4	Soil 5a	Soil 5b	Soil 6	Soil 7	Soil 8	Soil 9	Soil 10a	Soil 10b	Soil 11	Soil 12	Soil 13	Soil 14	Soil 15a	Soil 15b
Analyte	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97
	03"	03"	03"	46"	03"	1218"	04"	04"	35"	1824"	03"	1824"	03"	03"	06"	06"	03"	1824"
Pesticides (ug/kg)	[
Aldrin												-						
Chlordane	140		480	720	11,000		7,200	17,000	82,000	13,000	260	-	200	1,800				
4,4'-DDE	- 1							-	-			·				-		
4,4'-DDD																-		
4,4'-DDT					350	-	910	2,900	8,800	1,100			••		-			
Heptachior	-	-		-			-	-	-	-		-		•	-	-		
Herbicides (ug/kg)								·										
2,4-D		<u> </u>										-	-	-				
2,4,5-T			-											1,400		-		
Dicamba	130		-	50												-		
Silvex	-	-	-				80					-					-	
Semivolatiles (ug/kg)					······							·						
Acenaphthene				••														
Anthracene																		
Benzo[a]anthracene				1,400			••	780	-			-				-		
Benzo[b]fluoranthene		-		1,300								-	••			-		
Benzo[k]fluoranthene																		
Benzo[ghi]perylene																		
Benzo[a]pyrene		-	-															
Chrysene	-		-	1,600				1,000										
Dibenzo(a,h)anthracene		-				-	-								••			•-
Di-n-butylphthalate						-						-						
Fluoranthene				2,400			520	960					540					
Indeno[123-cd]pyrene				 ',							÷-							
Naphthalene		-				-	1,500				••							·
Ph en anthrene				1,600			550									-		••
Pyrene	-			3,200				1,500		 '		-						
Inorganics (mg/kg)																		
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Miscellaneous (mg/kg)							*-											
Ammonia	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate/Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

-- = not detected

NA = Not Analyzed

.

	Soil 16	Soil 17a	Soil 17b	Soil 18	Soil 19	Soil 20a	Soil 20b	Soil 21	Soil 21	Soil 22	Soil 23a	Soil 23b	Soil 24	Soil 25	Soil 26	Soil 27	Soil 28a	Soil 28b
Analyte	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97	Dec. '97
	03"	03"	1824"	03"	03"	03"	2430"	03"	duplicate	05"	05''	2430"	03"	03"	03"	03"	03"	2430"
Pesticides (ug/kg)																		
Aldrin	-	_					-											
Chlordane	8,200	8,600		·	4,400	8,200	-	1,600	2,700	-	520		240			280		
4,4'-DDE	_											-				-		
4,4'-DDD	-		-		-						-				-			
4,4'-DDT	-					340			~						120			
Heptachlor	-	-			-		-			-		-			-	-		
Herbicides (ug/kg)																		·
2,4-D		·,						••							-		••	
2,4,5-T										-								**
Dicamba	- 1																	
Silvex	-	-					-		-	-								
Semivolatiles (ug/kg)					· · · · ·									<u></u>				
Acenaphthene	-	-				-	-					-			5,700			
Anthracene	-											-			12,000			
Benzo[a]anthracene	·	••													36,000			
Benzo[b]fluoranthene					-				-						28,000			
Benzo[k]fluoranthene									-						9,600			
Benzo[ghi]perylene	- 1														13,000			-
Benzo[a]pyrene	-									-					21,000			
Chrysene	- 1			-	•		-								41,000			
Dibenzo(a,h)anthracene	-						-			-								
Di-n-butylphthalate	-										••							•••
Fluoranthene	-								-		880				87,000	••	1,300	1,000
Indeno[123cd]pyrene															14,000			
Naphthalene															22,000			
Phenanthrene	-														62,000		660	530
Pyrene	-								-				-		83,000		1,100	830
Inorganics (mg/kg)				· · · · · ·														
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Miscellaneous (mg/kg)					······								<u> </u>					
Ammonia	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate/Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

-- = not detected

NA = Not Analyzed

	Soil 29a	Soil 29b	Soil 30	Soil 31	Soil 32	Soil 33	Soil 34	Soil 35	Soil 35	Soil 36a	Soil 36b	Soil 38	Soil 39	Soil 40	B-73	B-74	B-75	B-76
Analyte	Dec. '97	Dec. '97	Dec. '97	Sept. '98	Sept. '98	Sept. '98	Aug. '98	Aug. '98	Aug. '98	Aug. '98								
	03"	2430"	05"	03"	03"	05"	05"	05"	duplicate	03"	2430"	05"	05"	05"	0-10'	06' _	06'	06'
Pesticides (ug/kg)	Γ																	
Aldrin				÷ _										-	-			-
Chlordane	5,600	11,000		13,000	1,300	47,000		59,000	77,000		790	130		270		10,300	460	690
4,4'-DDE	-	-			-				-		-			-		-		
4,4'-DDD	1,000	1,300		2,400		10,000		4,200	1,400	-			-		-	-		
4,4'-DDT	1,700	5,700		8,700		13,000	120	1,200	1,600	230	140							
Heptachlor	-										-			-				
Herbicides (ug/kg)							_											
2,4-D	-	·								-	40							
2,4,5-T	[_																	
Dicamba		·				110								-				
Silvex	-	-				-									-			
Semivolatiles (ug/kg)			_		<u></u>													
Acenaphthene	-	-								-		NA	NA	NA	NA	NA	NA	NA
Anthracene					-		**					NA	NA	NA	NA	NA	NA	NA
Benzo[a]anthracene									-			NA	NA	NA	NA	NA ·	NA	NA
Benzo[b]fluoranthene	-	-										NA	NA	ŇA	NA	NA	NA	NA
Benzo[k]fluoranthene	-											NA	NA	NA	NA	NA	NA	NA
Benzo[ghi]perylene		-										NA	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene			••		-							NA	NA	NA	NA	NA	NA	NA
Chrysene											-	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene												NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	1,000	-										NA	NA	NA	NA	NA	NA	NA
Fluoranthene	940		-		630	680				-		NA	NA	NA	NA	NA	NA	NA
Indeno[123cd]pyrene										-	-	NA	NA	NA	NA	NA	NA	NA
Naphthalene	-					-						NA	NA	NA	NA	NA	NA	NA
Phenanthrene								••	-			NA	NA	NA	NA	NA	NA	NA
Pyrene	830				-							NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)																		
Arsenic	NA	NA	NA	NA	NA	NA	20	14	75	20								
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA								
Mercury	NA	NA	NA	NA	NA	NA	0.027	0.850	0.170	0.250								
Miscellaneous (mg/kg)																		
Ammonia	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA								
Nitrate/Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA								

-- = not detected

NA = Not Analyzed

	B -77	B-78	OMS-SO-02	OMS-SO-04	OMS-SO-05	OMS-SO-07	OMS-SO-08	OMS-SO-09	OMS-SO-10	OMS-SO-11	OMS-SO-17	OMS-SO-18	OMS-SO-19	OMS-SO-20
Analyte	Aug. '98	Aug. '98	Dec. '94	Dec. '94	Dec. '94	Dec. '94	Dec. '94	Dec. '94	Dec. '94	Dec. '94				
•	06'	06'	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown
Pesticides (ug/kg)														
Aldrin						_					••		310	47
Chlordane	2,500	1,900				2,900	4,400	-	-	4,200	2,000	930	32,000	3,500
4,4'-DDE			4,400 J		16,000 J			-	-	-				
4,4'-DDD	-		24,000 J		20,000 J			-		-				
4,4'-DDT			100,000	-	550,000 J	-	-	-						
Heptachlor			3,500 J			-	180	-		-	•-		1,000	
Herbicides (ug/kg)		·····						-			·	- ·		
2,4-D			· -			-	-					-		-
2,4,5-T		-					-			-		-		
Dicamba		'-		-	-								-	
Silvex				-			-					-		
Semivolatiles (ug/kg)														
Acenaphthene	NA	NA				-		-					-	-
Anthracene	NA	NA			-					-				
Benzo[a]anthracene	NA	NA		-				-	-					
Benzo[b]fluoranthene	NA	NA	1,200					-				-		
Benzo[k]fluoranthene	NA	NA	-							-				
Benzo[ghi]perylene	NA	NA					-							
Benzo[a]pyrene	NA	NA	960					-		110 J				230
Chrysene	NA	NA	-				-	-		-				-
Dibenzo(a,h)anthracene	NA	NA	390							-				
Di-n-butylphthalate	NA	NA	-			-					-			
Fluoranthene	NA	NA				-								
Indeno[123cd]pyrene	NA	NA	930	`									••	
Naphthalene	NA	NA		-	-					-				
Phenanthrene	NA	NA											•	
Pyrene	NA	NA				-		- '		-				-
Inorganics (mg/kg)					·									
Arsenic	22	25	-		59		 .			-		••		-
Manganese	NA	NA	420	737	520			407	390			494		
Mercury	0.800	0.270	4.48	0.08	1.81	0.30	0.14	0.18	0.25	0.13	0.29	0.15	1.63	0.25
Miscellaneous (mg/kg)												<u> </u>		
Ammonia	NĂ	NA	990		759	**							-	
Nitrate/Nitrite	NA	NA	123		197	318	937	<u> </u>	103	336	1,070	1,210		

-- = not detected

NA = Not Analyzed

		OMS-SD-03	OMS-SD-13	OMS-SD-15	OMS-SD-16	Crosses Run RM 2.8	Crosses Run RM 2.0
PARAMETER NAME	UNITS	12/8/94	12/8/94	12/8/94	12/8/94	Summer 1995	Summer 1995
Aluminum Solid							
Ammonia	mg/kg			1.330			
Antimony, Solid	mg/kg			-	_	NA	NA
Arsenic, Solid	mg/kg		_	-	-	21.3	9.91
Barium, Solid	mg/kg	_			-		
Beryllium, Solid	mg/kg	-					-
Cadmum, Solid	mg/kg					0.435	0.305
Chromum Solid	mg/kg					530	<u> </u>
Cobalt, Solid	mg/kg	-					
Copper, Solid	mg/kg	-	-	-	-	936	25
Herbicides	mg/kg	BDL	BDL	BDL	BDL	BDL	BDL
Iron, Solid	mg/kg					10,000	17,400
Lead, Solid	mg/kg			=		488	
Magnesium, Solid	mg/kg	420		423			
Mercury Solid	mg/kg		_			NA	NA
Nickel, Solid	mg/kg	-	-	-	-	500	-
Nitrate/Nitrite	mg/kg	-		-	-		-
Percent Solids	%				-		
Pesticides	mg/kg	See Below	See Below	See Below	See Below	BDL	See Below
Priosphorus, Lotal	mg/kg						<u>⊢</u>
Selenium, Solid	mg/kg			<u> </u>			
Semi Volatile Compounds, SW8270	ug/kg	See Below	See Below	BDL	See Below	BDL	See Below
Silver, Solid	mg/kg		-	-		NA	NA
Sodium, Solid	mg/kg	-	-		-	-	-
Thallium, Solid	mg/kg						-
Vanadium, Solid	mg/kg		-			-	·····
Zing Solid	ug/kg			BDL		1 000	121
Herbicide Detections	110/20					1,000	
2,4,5-T	ug/kg				<u> </u>		
Pesticide Detections				1			
Aldrin	ug/kg	-	61	49		-	
Chlordane	ug/kg	7,100	-	3,900	5,400	NA NA	NA
4,4'-DDD	ug/kg						10
4,4-DDE	ug/kg				<u> </u>		
delta-BHC	110/60						10
Dieldrin	ug/kg						28
Endrin	ug/kg			-	-	-	-
Endrin ketone	ug/kg		-				-
Heptschlor	ug/kg			=			
Heptschlor epoxide	ug/kg			-	-	-	16
	ug/kg				<u> </u>		29
Acenaphthene	ug/re						0.0
Anthracene	ug/kg	_		_		-	18
Benzo[a]anthracene	ug/kg	-	_	- 1	- ·] -	3.7
Benzo[b]fluoranthene	ug/kg	-	-	-	-		-
Benzo[k]fluoranthene	ug/kg	-	88J		-		-
Benzo[a]pyrene	ug/kg	390			380		3.2
Benzolgh iperviene	ug/kg			<u> </u>			2.3
Chrysene	ug/kg	<u> </u>			<u>+</u>		
Dibenzo[a,h]anthracene	ug/kg				110	-	0.9
Fluoranthene	ug/kg		-	-			8.4
Fluorene	ug/kg	-		-		-	0.8
Hexachloro-benzene	ug/kg					-	-
Indeno(1,2,3-c,d) pyrene	ug/kg				<u> </u>		3.3
Pyrene	ug/kg						7.4
VOC Detections		<u> </u>		<u> </u>	+		<u> 0.0</u>
Acetone	ug/kg		<u> </u>	<u> </u>	<u> </u>	·····	
Hexane	ug/kg	<u> </u>		<u> </u>	<u>├</u>		
Methylene chloride	ug/kg		-				-

BDL = All constituents analyzed were below inborns -- = Below detection immit. NA = Not Analyzed. = = Detection result reported below laboratory EQL J = The sumercal value is an estimated quantity. ary detection limits

5/19/99

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		Crosses Run RM 0.8	North Branch Crosses Run RM 0.9	North Branch Crosses Run RM 0.1
PARAMETER NAME	UNITS	Summer 1995	Summer 1995	Summer 1995
Aluminum, Solid	mg/kg	_	-	
Ammonia	mg/kg			<u> </u>
Antimony, Solid	mg/kg	NA	<u>NA</u>	NA
Arsenic, Solid	mg/kg	28.1	22.7	17.4
Barum, Solid	mg/kg	·		
Beryllium, Solid	mg/kg		0.228	
Cadmium, Solid	mg/kg	0.303	0.328	1.03
Chromium Solid	mg/kg	20.2	22.0	90.3
Cabelt Solid	mg/kg		<u></u>	
Copper Solid	ma/kg	28.1	172	48
Herbicides	mg/kg	See Below	BDI.	BDL
Iron Solid	mg/kg	34,900	31,300	31.800
Lead. Solid	mg/kg	18.4	15.8	
Magnesium, Solid	mg/kg			_
Manganese, Solid	mg/kg			
Mercury, Solid	mg/kg	NA	NA	NA
Nickel, Solid	mg/kg	43.2	27.8	49.2
Nitrate/Nitrite	mg/kg			
Percent Solids	%	-		
Pesticides	mg/kg	See Below	See Below	See Below
Phosphorus, Total	mg/kg	-		
Potassium, Solid	mg/kg	_		
Selenium, Solid	mg/kg	-		-
Semi Voiatile Compounds, SW8270	ug/kg	BDL	BDL	See Below
Silver, Solid	mg/kg	NA	NA	NA
Sodium, Solid	mg/kg	-	-	-
Thallium, Solid	mg/kg		-	
Vanadium, Solid	mg/kg	→	-	
Volatile Compounds, SW8260	ug/kg_			
Zinc, Solid	mg/kg	109	57.6	317
Herbicide Detections				
2,4,5-T	ug/kg	-	-	-
Pesticide Detections				
Aldrin	ug/kg	-	-	-
Chlordane	ug/kg	NA	NA	NA
4,4'-DDD	ug/kg	23		17
4,4'-DDE	ug/kg	-	-	-
4,4'-DDT	ug/kg	20		14
delta-BHC	ug/kg	-	-	
Dieldrin	ug/kg		-	20
Endrin	ug/kg		-	-
Endrin ketone	ug/kg		-	-
Heptachlor	ug/kg			
Heptachlor epoxide	ug/kg	14	-	_
Methoxyclor	ug/kg	<u> </u>		30
SVOC Detections				
Acenaphthene	ug/kg	– ·	-	-
Anthracene	ug/kg		-	1.0
Benzo[a]anthracene	ug/kg		- ·	6.0
Benzo[b]fluoranthene	ug/kg	-		
Benzo[k]fluoranthene	ug/kg	-	<u> </u>	-
Benzo[a]pyrene	ug/kg			7.5
Benzo[g,h,i]perylene	ug/kg			7.7
Bis(2-ethylhexyl)phthalate	ug/kg			0.9
Chrysene	ug/kg			8.7
Dibenzo[a,h]anthracene	ug/kg		<u> </u>	2.5
Fluoranthene	ug/kg			17.6
Fluorene	ug/kg			
Hexachloro-benzene	ug/kg_			13
Indeno(1,2,3-c,d) pyrene	ug/kg	· · · · · · · · · · · · · · · · · · ·		8.9
Phenanthrene	ug/kg_			7.3
Рутепе	ug/kg			13.8
VOC Detections	· · ·			
Acetone	ug/kg	-	-	
Hexane	ug/kg			
Methylene chloride	ug/kg	-		

Table 2.6 Sediment Analytical Results for Quarterly Sampling Events. The Scotts Company, Marysville, Ohio.

PARAMETER NAME UTTS 111999 21097 520.07 111997 220.89 62.99 111996 21097 Amanum. Solid mg/a 56.00 NA 6.70 10 6.4 13 6.20 13 6.47 719 51 6.4 13.2 2.9 13 Amanum. Solid mg/a 6.03 0.07 0.70 0.1 6.0 13.2 9.2 0.31 Amanum. Solid mg/a 6.03 0.07 0.70 0.10 10.5 11.6 11.0 1.1 1			SS-1	SS-1	SS-1	SS-1	SS-1	SS-1	SS-1	SS-2	SS-2	SS-2	SS-2
Administriki mg/kg 9.00 MA 6.00 MA MA III 1.000 MA Assession mg/kg 10.37 3.37 6.07 -0.10 -5.11 4.0 MA 110 2.9 1.1 Assession mg/kg 10.17 19.44 12.9 6.7 2.8 5.2 1.3 1.4 Breum, Sold mg/kg 6.6 10.0 11.5 10.5 12.0 8.5 9.9 11.0 Calutan Sold mg/kg 6.6 10.0 11.0 1 1 1 1 1 1.0 0.6 Calutan Sold mg/kg 10.0 10	PARAMETER NAME	UNITS	11/19/96	2/10/97	5/20/97	8/27/97	11/19/97	2/26/98	6/23/98	11/19/96	2/10/97	5/20/97	8/27/97
memory mp/gk 40 71 93 94 93 94 93 97 94 93 97 93	inum Solid	me/kg	9.600	NA	6.720	8,900	NA	NA	NA	13,000	NA	8.340	6.980
namone, Solid mg/kg 40,27 40,11 0.963 0.70 -0.1 -0.10 -0.12 -0.23 -0.31 tarium, Solid mg/kg 164 100 100 81.3 105 120 85 99 110 tarium, Solid mg/kg 163 100 15 -1 1 100 100 arbum, Solid mg/kg 1600 NA 0.1500 95.00 NA NA NA NA NA 100 100 100 100 100 100 100 NA 100	0018	mg/kg	21	3.3	<247	<19	51	4.0	13.2	29	15	<270	<23
stenic. Sold mg/g 10 17 19.4 12.9 6.7 28 52 13 14 exhlum. Sold mg/g 16.5 0.87 0.720 0.490 1 1 1 1 0 16.6 0.86 athama. Sold mg/g 0.23 0.490 1 1 1 1 1 1 0.86 bib. Sold mg/g 0.21 0.21 0.44 N N NA NA NA 1.0	nony, Solid	mg/kg	<0.29	<0.11	0.983	0.70	<0.1	<1.0	<1.2	<0.29	<0.31	0.938	<0.78
main Sold mg/kg 64 100 100 81.5 105 120 87 99 110 Admun. Sold mg/kg 0.23 NA 0.010 -0.00 -1 1 1 1 0.042 NA Admun. Sold mg/kg 0.23 NA 0.010 -2.00 NA	uc, Solid	mg/kg	10	17	19.4	12.9	6.7	28	5.2	13	14	13.1	8.77
syntam. Solid mg/sg. 0.03 0.670 0.490 1 1 1 1 1 1 1 0.84 LateumSold mg/sg. 0.630 NA 0.618 -0.13 3 -4 -5 0.42 NA LateumSold mg/sg. 0.600 NA 2.120 0.94 NA NA NA D2 2.022 Sold mg/sg. 1.0 1.1 1.1 1.1 0.84 NA	m. Solid	mg∕kg	64	100	100	81.5	105	120	85	99	110	82.1	84.7
addmam. Sold mg/sg 0.73 NA 0.011 = 0.13 -3 <3 <3 <3 0.42 NA humman, idi mg/sg 1.3 0.71 1.13 0.71 1.44 NA NA NA NA NA NA NA NA NA 1.20 NA <	lium, Solid	mg/kg_	0.63	0.87	0.720	0.490	1	1	1	1	0.86	0.618	0.52
adoum. Solid mg/sg 8.000 NA 29.300 NA NA NA 120.00 NA Johal. Zolid mg/sg 19 21.1 16 11.2 14 8 7 12 13 21 Johal. Zolid mg/sg 19 21.0 22.6 AN NA NA 22.2 23.2 sens. Solid mg/sg 16.000 NA 23.2 11.4 10 23.2 21.4 10 23.2 11.4 10 23.2 11.4 10 23.2 11.4 10 23.2 11.4 10 23.2 11.4 10 23.2 11.4 10 23.2 11.4 10 23.2 11.4 10 23.2 11.4 10 23.2 11.4 10 23.2 11.4 10 23.2 11.4 10 23.2 11.4 10 23.2 11.4 10 23.2 11.4 10 23.2 13.2 11.4 10.2	ium, Solid	mg/kg	0.28	NA	0.618	<0.13	5	3	<5	0.42	NA NA	0.398	<0.16
Attention PBP28 11 10 11.5 11.4 N LA LA DD LD Solid mp242 13 270 213 2.6 NA	um, Solid	mg/kg	8,600		21,500	59,500	NA		<u>NA</u>	13,000		15,600	22,000
addit mp#4 10 4.1 4.1 2.1 2.6 NA NA NA Dist Dist NA Dist NA Dist NA Dist NA NA <thna< th=""> NA <thna< th=""></thna<></thna<>	mium, Solid	mg/kg	11	10	11.2	14.4	0	/	12 NA	15	20.2	13.3	11.4
appendix mp24 DD NA PEX DDL NA NA NA NA PEX DDL NA PEX DDL NA PEX DDL NA NA PEX DDL NA PEX DDL NA PEX DDL NA PEX PEX DDL NA NA PEX PEX DDL NA PEX PEX DDL NA PEX PEX DDL PEX PEX DDL PEX PEX DDL PEX PEX DDL DEX PEX DEX PEX DEX PEX DEX DEX	it, Solid	mg/kg	13	27.1	22.0	9.4		NA NA		20	20.2	13.2	8.56
Internation IDDA (a) IDA (a)	er, Sonu	mg/kg	19	NA	21.2 NA	20.0	BDI				NA NA	<u> </u>	20.8
Diad 199 100 101 101 101 121 122 121 122 133 Magnetine, Solid 199 4 500 NA 6520 NA NA NA NA 800 NA Magnetine, Solid 199 4 101 401 NA NA 660 0.003 Nited, Solid 199 4 19 34 0.003 0.013 342 392 34 19 34 0.003 Nited, Nitrike 199 64 1 19 34 0.003 0.003 Na Na Na Na Na Na Na 19 34 0.003 100 100 7.005 1.01 1.01 1.1 1.01 1.1 1.01 1.1 1.01 1.1 1.01 1.1 1.01 1.1 1.01 1.1 1.01 1.1 1.01 1.1 1.01 1.1 1.01 1.1 1.01 1.1	Solid	mg/kg	16,000	NA	26 500	23.000	NA	NA NA	NA	24,000	NA	21 800	17,000
Signature. Solid rpsg. 5.00 NA 6.20 19.700 NA NA NA Sec Marganes. Solid rpsg. 0.08 0.019 0.113 -011 0.10 -040 118 0.04 0.023 Marcary, Solid rpsg. 2.1 1.3 5.4 3.2 3.9 9.4 1.9 9.4 0.6 0.023 Sintal, Solid rpsg. 2.1 1.3 5.4 3.2 3.9 9.4 1.9 9.4 3.6 7.0 7.1 5.51 6.69 6.41 4.8 5.7 Parenz Solid rpsg. 9.20 4.60 3.21 -7 7.0 NA NA NA 2.300 12.0 -16 3.0 3.0 13.0 14.0 2.30 13.0 NA 2.30 13.0 NA NA NA NA NA 2.300 13.0 NA 12.0 10.1 NA NA NA 2.300 18.0 NA	Solid	mg/kg	16	NA	20,500	114	10	23	21	24,000	NA NA	194	17.000
vargeness. Solid ng/kg 450 1100 1.110 411 NA NA 640 970 wireary, Solid mg/kg 23 41 354 342 39 34 19 34 0.003 wireary, Solid mg/kg 210 (1) 396 342 39 34 19 34 0.002 wireary, Solid mg/kg 210 (1) 396 2266 <(1)	esium Solid	mg/kg	5 600	NA	6 920	19 700	NA	NA	NA	8 600	NA	6 320	6.610
versure, Solid mg/kg 0.09 0.013 40.11 0.10 0.04 0.18 0.04 0.023 siteal. Solid mg/kg 32.3 41 35.4 39.3 41 19 34 19 34 19 34 19 34 19 34 19 34 19 34 16 11 -10 1 -10 1 -10 1 -10 1 -10 1 -10 12 11 10 120 1200 1200 1200 1200 1200 1200 1200 130 1400 NA 2280 NA NA NA NA NA NA NA 130 20.5 13.6 0.3 0.51 13.6 0.3 0.21 13.8 2407 13.8 40.6 0.3 0.2 0.51 NA NA NA 13.2 0.30 12.2	anese Solid	mg/kg	450	1100	1,110	411	NA	NA	NA	680	970	675	426
vistel. Solid mg/kg 23 41 35 4 342 39 34 19 34 36 SintexNirrie mg/kg 80 40.0 <1	ury. Solid	mg/kg	0.08	0.019	<0.13	<0.11	0.10	<0.04	0.18	0.04	0.023	<0.14	<013
sintat/Nirie mg/kg <10 <1 396 296 <1 <1 <10 1 Semens Solid mg/kg BDL BDL Sem Below BDL	el, Solid	mg/kg	23	41	35.4	34.2	39	34	19	34	36	24.7	18.5
Percent Solida '% 69 68 72.6 75.1 55.1 59.9 64.1 48 57 Phosphons, Total mg/kg BDL BDL See Below See Below BDL	te/Nitrite	mg/kg	<1.0	<1	3.96	2.96	<1	<1	<u> </u>	<1.0	1	<7.2	3.1
$\besides my kg BDL BDL See Below See Below BDL BDL See Below BDL BDL BDL BDL BDL BDL BDL BDL Prostors. Solid my kg 2.300 1400 NA 2.980 NA NA NA NA 2.00 1200 Prostors. SW270 wf kg DDL BDL BDL BDL BDL BDL BDL BDL BDL BDL$	nt Solids	%	69	68	72.6	75.1	55.1	69.9	64.1	48	57	58.7	57.8
Phosphons, Total mg/kg 380 460 32.1 $<$ $<$ NA O O O O O O O O O O O O O O O NA NA NA NA O NA NA O NA NA NA O NA NA NA NA NA NA NA <thna< th=""> NA NA</thna<>	rides	mg/kg	BDL	BDL	See Below	See Below	BDL	BDL	See Below	BDL	BDL	See Below	See Below
Potasum, Solid mg/sg. 2.300 1400 NA 2.980 NA NA NA 2.500 2200 Semuru, Solid mg/sg. 40.36 NA 1.09 40.67 40.5 40.6 Additional Addition	phorus, Total	mg/kg	380	460	32.1	<2.7	NA	NA	NA	1200	1200	122	157
	sium, Solid	mg/kg	2,300	1400	NA	2,980	NA	NA	NA	2,500	2300	NA	1,160
Semi Voltiti Compounds, SW8270 upkg BDL BDL <th< td=""><td>ium, Solid</td><td>mg/kg</td><td><0.36</td><td>NA</td><td>1.09</td><td><0.67</td><td><0.5</td><td><1.6</td><td>0.3</td><td>⊲0.51</td><td>NA</td><td>0.949</td><td><0.78</td></th<>	ium, Solid	mg/kg	<0.36	NA	1.09	<0.67	<0.5	<1.6	0.3	⊲0.51	NA	0.949	<0.78
Silver, Solid mg/kg (-0.13) NA (-0.78) (-0.67) NA NA NA (-0.19) NA (-0.19) NA (-0.19) NA (-0.10) mg/kg (-0.34) (-0.67) (-0.4) (-0.3) (-0.2) (-0.51) NA (-0.3) (-0.2) (-0.51) (Volatile Compounds, SW8270	ug/kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sodium mg/kg 330 NA 125 155 NA NA NA MA Vanadium, Solid mg/kg 330 NA 122 40.57 0.4 40.3 0.2 0.51 NA Vanadium, Solid mg/kg 566 NA 23.0 18.9 NA NA NA NA NA NA NA Volatie Compounds, SW220 ug/kg 80 NA 81.7 65.7 61 54 51 130 NA Thicida Detections	r, Solid	mg/kg	<0.13	NA	<0.78	<0.67	NA	NA	NA	<0.19	NA	<0.90	<0.78
	ım, Solid	mg/kg	330	NA	125	155	NA	NA	NA	400	NA	200	247
Variadum, Solid mg/kg C66 NA 23.0 18.9 NA N	ium, Solid	mg/kg	0.34	NA	1.32	<0.67	0.4	<0.3	0.2	0.51	NA	1.01	<0.78
Volatic Compounds, SW260 ug/kg See Below NA See Below BDL BDL BDL BDL NA Ten, Solid mg/kg 80 NA 81.7 65.7 61 54 51 130 NA ST ug/kg 40.04 NA NA See Below	dium, Solid	mg/kg	<66	<u>_NA</u>	23.0	18.9	NA	NA	NA	<94	NA	22.0	16.5
Line, Solid mg/Kg 80 NA 81.7 65.7 61 54 51 130 NA [5:T ug/kg <0.04	tile Compounds, SW8260	ug/kg	See Below	NA	See Below	See Below	BDL	BDL	BDL	BDL	<u>NA</u>	See Below	See Belov
Thickie Detections Image: Sriphon Signature Image: Sripho	Solid	mg/kg	80	NA	81./	63./	01		1 51	130	NA	90.2	85.7
b-1 ug/g -20,04 NA A <10 <40 <40 <40 <40 <40 <40 <40 <40 <40 <40 <40 <40 <40 <40 <40 Aldrin ug/kg <50	Dicide Detections												<u> </u>
resticied Detections	•T	ug/kg	<0.04			<1.0	<40	<40	<40	<0.04	NA NA	<u>NA</u>	<1.0
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	icide Detections							l		ļ			
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	<u>n</u>	ug/kg	<50	<200	1.8	<2.40	<20	<20	<20	<50	<200	<2.8	<2.20
4.4-DD ug/kg <100	rdane	ug/kg	<200	<5,000	<110	11.40	<100	<100	1900	<200	<5,000	17	16.50
4.4-DD ug/kg <100 <800 1.0 0.830 ⁻⁴ <30 <30 <30 <100 <600 4.4-DDT ug/kg <100 <600 <4.5 <4.70 <30 <30 <30 <100 <600 delta-BHC ug/kg <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <600 - Endrin ug/kg <20 <600 3.7 2.10° <20 <20 <20 <20 <20 <600 - <t< td=""><td></td><td>ug/kg</td><td><100</td><td><600</td><td>0.49</td><td>1.80*</td><td><20</td><td><20</td><td><20</td><td><100</td><td><600</td><td>0.73</td><td>1.40</td></t<>		ug/kg	<100	<600	0.49	1.80*	<20	<20	<20	<100	<600	0.73	1.40
4.4-D1/1 ug/kg <100		ug/Kg_	<100	<600	1.0	0.830+	<30	<30	<30	<100	<600	0.70	1.10
Link Phr. Lyg Lg Color NA C2.0 C2.0 <td>PUC</td> <td>ug/kg</td> <td><100</td> <td><000</td> <td><4.3</td> <td><4.70</td> <td>30</td> <td><u> </u></td> <td><u></u></td> <td><100</td> <td><000</td> <td>< 0.0</td> <td>0.930*</td>	PUC	ug/kg	<100	<000	<4.3	<4.70	30	<u> </u>	<u></u>	<100	<000	< 0.0	0.930*
Direction ug/kg 20 500 3.7 2.10 50 720 520 520 520 560 Endrin ug/kg 700 6600 <4.5	-влс	ug/kg	<	NA	2.3	2.40	20	20	<u>~20</u>	<u> </u>		<2.8	1.70-
Linum ug/kg (10) (20) (31)	401	ug/kg	20	<000	5.7	2.10	<50	<50	<20		<000	4.0	5.00
And Internation ug/kg (MA (MA <td>in ketone</td> <td><u>ug/kg</u></td> <td>NA</td> <td>NA</td> <td>NA NA</td> <td><4.70</td> <td>NA</td> <td>NA</td> <td>NA</td> <td>NA</td> <td>NIA</td> <td><u></u></td> <td><4.40</td>	in ketone	<u>ug/kg</u>	NA	NA	NA NA	<4.70	NA	NA	NA	NA	NIA	<u></u>	<4.40
Improvint ug/kg -50 -200 -210 -210 -210 -30 -30 -30 -200 -200 Methoxyclor ug/kg -	achior	ug/kg	<50	<200	03	<7.10	S10	30	NA	<50	200		2 20
Instruction Up / E Up	achior epoxide	ug/kg	<800	<200	0.99	<2.40	<	30	<10	<800	<200	1.6	4.40
SVOC Detections ug/kg -	oxyclor	ug/kg							1				
Accenaphtene ug/kg -	C Detections				1	 	†			+	1	1	
Anthracene ug/kg -	aphthene	valka	<u> </u>	<u> </u>	<u> </u>			<u> </u>		<u> </u>	<u>}</u>	<u>↓</u>	╆━━━━━
Benzo[a]anthracene ug/kg <490 <470 <450 <443 <750 <750 <750 <570 Benzo[a]anthracene ug/kg <490	Brene	ug/kg								<u> </u>		f	
Benzols/Inversion ug/kg c470 c470 c443 c100 c100 c500 c570 Benzols/Ifluoranthene ug/kg c470 c450 c443 c1,000 c1000 c590 c570 Benzols/Ifluoranthene ug/kg c490 c470 c450 c443 c1,000 c1,000 c590 c570 Benzols/Ifluoranthene ug/kg c490 c470 c450 c443 c1,000 c1,000 c1000 c590 c570 Benzols/Ifluoranthene ug/kg c470 c450 c443 c1,000 c1,000 c1000 c590 c570 Benzolg.h.iperylene ug/kg c470 c450 c443 c1,000 c1,000 c1000 c590 c570 Bis(2-ethylhexyl)phthalate ug/kg c490 c470 c450 c443 c750 c750 c590 c570 Dibenzolg.h.janthracene ug/kg c490 c470 c450 c443 c500 c500 c590 c570 <td>olalaptbracene</td> <td>110/kg</td> <td><490</td> <td><470</td> <td><450</td> <td><443</td> <td><750</td> <td><750</td> <td><750</td> <td>< 690</td> <td><570</td> <td><570</td> <td>-530</td>	olalaptbracene	110/kg	<490	<470	<450	<443	<750	<750	<750	< 690	<570	<570	-530
Benzolk/fluoranthene ug/kg <th<< td=""><td>oiblfuoranthene</td><td>10/10</td><td><490</td><td><470</td><td><450</td><td><443</td><td><1,000</td><td><1,000</td><td><1000</td><td><690</td><td><570</td><td><570</td><td><530</td></th<<>	oiblfuoranthene	10/10	<490	<470	<450	<443	<1,000	<1,000	<1000	<690	<570	<570	<530
Benzola pyrene ug/kg <	o[k]fluoranthene	up/kg	<490	<470	<450	<443	<1,000	<1,000	<1000	<690	<570	<570	<530
Benzolg,h:liperylene ug/kg - <td>olalpyrene</td> <td>uo/ko</td> <td><490</td> <td><470</td> <td><450</td> <td><443</td> <td><1.000</td> <td><1.000</td> <td><1000</td> <td><690</td> <td><570</td> <td><570</td> <td><530</td>	olalpyrene	uo/ko	<490	<470	<450	<443	<1.000	<1.000	<1000	<690	<570	<570	<530
Bis(2-ethylhexyl)phthalate ug/kg - <th< td=""><td>olghilpervlene</td><td>ug/kg</td><td>-</td><td></td><td></td><td>-</td><td>-</td><td></td><td>-</td><td>-</td><td></td><td></td><td></td></th<>	olghilpervlene	ug/kg	-			-	-		-	-			
Ug/kg <490 <470 <450 <443 <750 <750 <750 <690 <570 Dibenzo[a,h]anthracene ug/kg	2-ethylhexyl)phthalate	ug/kg			-	-	-	-	-		~		<u>+</u>
Dibenzo[a,h]anthracene ug/kg	sene	ug/kg	<490	<470	<450	<443	<750	<750	<750	<690	<570	<570	<530
Fluoranthene ug/kg <490 <470 <450 <443 <500 <500 <690 <570 Fluoranthene ug/kg	nzo[a,h]anthracene	ug/kg					-		-		-		
Fluorene ug/kg	ranthene	ug/kg	<490	<470	<450	<443	<500	<500	<500	<690	<570	<570	<530
Hexachloro-benzene ug/kg </td <td>rene</td> <td>ug/kg</td> <td></td> <td>-</td> <td>-</td> <td></td> <td>-</td> <td>†<u> </u></td> <td>-</td> <td>-</td> <td></td> <td>-</td> <td><u> </u></td>	rene	ug/kg		-	-		-	† <u> </u>	-	-		-	<u> </u>
Indeno(1.2.3-c,d) pyrene ug/kg <490 <470 <450 <443 <1.200 <1.200 <690 <570 Phenanthrene ug/kg <490	chloro-benzene	ug/kg				- 1	-			- 1			
Phenanthrene ug/kg <490 <470 <450 <443 <500 <500 <690 <570 Pyrene ug/kg <490	no(1,2,3-c,d) pyrene	ue/ke	<490	<470	<450	<443	<1.200	<1.200	<1.200	<690	<570	<570	<530
Pyrene ug/kg <490 <470 <450 <443 <750 <750 <750 <590 <570	anthrene	ug/kg	<490	<470	<450	<443	<500	<500	<500	<690	<570	<570	<530
	ne	ug/kg	<490	<470	<450	<443	<750	<750	<750	<690	<570	<570	<530
VOC Detections	Detections				1	í -	1		1	<u>+</u>	1	<u> </u>	
Acctone ug/kg 133 NA 81 656* <100 <100 <100 NA	one	up/tro	133	NA NA	81	6.56*	<100	<100	<100	<180	ΝΔ	44	< KA+
Hexane ug/kg NA NA NA <685 NA NA NA NA NA NA	ine	<u>ue/ko</u>	NA	NA	NA	<6.85	NA	NA	NA NA	NA	NA	NA NA	1 23+
thylene chloride works 66 NA 18 350° <5 <5 <5 <0 NA	viene chloride	ug/ko		NA	18	3 52*	1 25	<5			NA NA	13	3.60*

Table 2.6 Sediment Analytical Results for Quarterly Sampling Events. The Scotts Company, Marysville, Ohio.

· · · · · · · · · · · · · · · · · · ·		SS-2	SS-2	SS-2	SS-3	SS_3	SS_1	SS-3	SS_3	55.3	SS_3
PARAMETER NAME	UNITS	11/19/97	2/26/98	6/23/98	11/20/96	2/10/97	5/20/97	8/27/97	11/19/97	2/26/98	6/23/98
Aluminum Solid	melke	NA	NA	NA	13,000	NA	10 200	8 210	NA	NA	NA
Ammonia	mg/kg	17	7.6	6.5	41	10	<276	<26	37	37	73
Antimony, Solid	mg/kg	<0.1	<1.4	<1.2	<0.26	<0.18	<0.90	<0.86	<0.1	<1.1	<1.2
Arsenic, Solid	mg/kg	3.2	24	1.9	12	11	18.3	19.4	5.3	13.8	2.2
Barium, Solid	mg/kg	68	81	73	89	78	96.9	64.0	83	68	47
Beryllium, Solid	mg/kg	0.4	<0.5	1	0.85	0.7	0.643	0.51	0.5	0.4	<0 4
Cadmium, Solid	mg/kg	4	<4	<5	0.36	NA	0.533	<0.17	3	<4	<5
Calcium, Solid	mg/kg	ŇA	NA	NA	5,100	NA	16,900	8,580	NA	NA	NA
Chromium, Solid	mg/kg	9	5	7	19	28	27.5	15.2	20	14	9
Cobalt, Solid	mg/kg	NA	NA	NA	19	15.3	12.9	8.39	NA	NA	NA
Copper, Solid	mg/kg	NA	NA	NA	25	NA	30.2	20.2	NA	NA	NA
Herbicides	mg/kg	BDL	BDL	BDL	BDL	NA	NA	BDL	BDL	BDL	BDL
Iron, Solid	mg/kg	NA	NA	NA	27,000	NA	25,400	22,400	NA	NA	NA
Lead, Solid	mg/kg	11	19	13	20	NA	24.0	12.9	14	17	7
Magnesium, Solid	mg/kg	NA		NA	7,300	<u>NA</u>	9,510	4,560	NA	<u>NA</u>	NA
Manganese, Solid	mg/kg	NA	NA	NA	510	440	509	271	NA	<u>NA</u>	NA
Mercury, Solid	mg/kg	0.04	<0.03	<0.03	0.37	0.34	1.03	<0.14	1.12	0.58	0.31
Nickel, Solid	mg/Kg	24	19	21	- 00		11.0	40.3		1	1.5
Dement Solids	- mg/kg •/	72 7	70.5	720	<u> </u>		65.1	71.2	620	62.6	1 70.5
Perticides	malka	BDI	10.5	BDL	See Below	BDI	See Below				
Phosphones Total	me/ke	NA NA	NA	NA	100	880	470	21.4	NA	NA NA	NA NA
Potassium Solid	mp/ko	NA	NA	NA	2 100	1500	NA NA	1 760	NA NA	NA	NA NA
Selenium, Solid	me/ko	<0.6	<2.2	<0.3	<0.32	NA	<0.90	<0.86	<0.5	<2.0	<0.3
Semi Volatile Compounds, SW8270	ug/kg	BDL	BDL	BDL	See Below	See Below	BDL	See Below	BDL	BDL	BDL
Silver, Solid	mg/kg	NA	NA	NA	<0.14	NA	<0.90	<0.86	NA	NA	NA
Sodium, Solid	mg/kg	NA	NA	NA	190	NA	147	149	NA	NA	NA
Thallium, Solid	mg/kg	0.3	⊲0.4	0.2	0.3	NA	1.26	<0.86	0.3	<0.4	0.1
Vanadium, Solid	mg/kg	NA	NA	NA	<71	NA	23.2	18.5	NA	NA	NA
Volatile Compounds, SW8260	ug/kg	BDL	BDL	BDL	BDL	NA	See Below	See Below	BDL	BDL _	BDL
Zinc, Solid	mg/kg	55	61	51	120	NA	197	72.2	100	70	50
Herbicide Detections											
2,4,5-T	ug/kg	<40	<40	<40	<0.04	NA	NA	<1.0	<40	<40	<40
Pesticide Detections		j									
Aldrin	ug/kg	<20	<20	<20	<50	800	14	13.0	<20	<20	<20
Chlordane	ug/kg	<100	<100	<100	450	9,100	2,000	520	14,000	410	1,900
4,4'-DDD	ug/kg	<20	<20	<20	<100	<600	24	40.0	<20	<20	<20
4,4-DDE	ug/kg	<30	<30	<30	<100	<600	<5.1	17.0	<30	<30	<30
4,4'-DDT	ug/kg	<30	<30	<30	<100	<600	58	77.0	<30	<30	<30
delta-BHC	ug/kg	<20	<20	<20	<50	NA	<2.5	<2.50	<20	<20	<20
Dieldrin	ug/kg	<20	<20	<20	<20	<600	7.8	4.20*	<20	<20	<20
Endrin	ug/kg	<50	<50	<50	<700	<600	2	11.0	<50	<50	<50
Endrin ketone	ug/kg	NA	NA	NA	NA	NA	NA	<4.80	NA	NA	NA
Heptachlor	ug/kg	<30	<30	30	<50	<200	18	20.0	<30	<30	<30
Heptachlor epoxide	ug/kg	30	<30	<30	<800	<200	150	110	<30	<30	
Methoxyclor	ug/kg		<u> </u>				<u> </u>				
SVUC Detections	+		ļ <u> </u>		<u> </u>			<u> </u>			
Acenaphthene	ug/kg			<u>-</u>							
Anurscene	ug/kg		-					107	-		-
Dento[a januracene	ug/kg	20</td <td><!--20</td--><td><!--20</td--><td>641</td><td><480</td><td>< 500</td><td>18/*</td><td><!-- 20</td--><td><100</td><td><!--50</td--></td></td></td></td>	20</td <td><!--20</td--><td>641</td><td><480</td><td>< 500</td><td>18/*</td><td><!-- 20</td--><td><100</td><td><!--50</td--></td></td></td>	20</td <td>641</td> <td><480</td> <td>< 500</td> <td>18/*</td> <td><!-- 20</td--><td><100</td><td><!--50</td--></td></td>	641	<480	< 500	18/*	20</td <td><100</td> <td><!--50</td--></td>	<100	50</td
Benzolkifluoranthene		<1,000	<1,000	<1.000	640	<480	200	1698	<1,000	<1,000	<1,000
Benzola Invrene	110/40	<1.000	<1,000	<1,000	605	<480	<500	<570	<1 000	<1.000	<1.000
Benzolg h ilperviene	ue/ke	-1,000		-1,000					-1,000		
Bis(2-ethylhexyl)mhthalate	ug/kro	+					<u> </u>	<u> </u>		t <u>-</u>	<u> </u>
Chrysene	100/ko	<750	<750	<750	757	<480	<500	289*	<750	<750	<750
Dibenzola hlanthracene	<u></u>		-					<u> </u>			
Fluoranthene		<500	<500	<500	1.067	940	<500	555*	<500	<500	<500
Fluorene	ug/kg	-	-		-	-				-	-
Hexachioro-benzene	ug/kg	-				- 1	-			-	
Indeno(1,2,3-c,d) pyrene	ug/kg	<1.200	<1.200	<1.200	<490	<480	<500	127*	<1.200	<1.200	<1.200
Phenanthrene	ug/kg	<500	<500	<500	636	649	<500	284*	<500	<500	<500
Рутепе	ug/kg	<750	<750	<750	1,204	812	<500	340*	<750	<750	<750
VOC Detections	1		İ		i	<u> </u>					
Acetone	uz/kg	<100	<100	<100	<114	NA	68	31.8	<100	<100	<100
Heyape		NA	NA	NA	NA	NA	NA	<8.62	NA	NA	NA
	42/82	4 14 6									

Table 2.6 (continued) Stream Sediment Sampling Results Collected Between 12/97 and 1/98 (all results in ug/kg). The Scotts Company, Marysville, Ohio.

			S	tream S	ediment	Samplir	ig Location	n		
Compounds	1	2	3	4	5	6	7	8	9	10
Pesticides										<u> </u>
Chlordane	2,500			400	200					
4,4'DDD										
4,4'DDT	340									
Herbicides										
2,4D	150									
Semivolatiles			· · · · · ·							
Acenaphthene						~-	89,000			
Anthracene			**		11,000		140,000			
Benzo[a]anthracene	900				30,000		240,000			
Benzo[b]fluoranthene					28,000		73,000	+-		
Benzo[k]fluoranthene					9,800					
Benzo[ghi]perylene					7,800					
Benzo[a]pyrene				-	20,000		130,000			
Chrysene	1,000				32,000		260,000			
Dibenzofuran					6,000		53,000			
Fluoranthene	1,500				79,000		560,000			
Fluorene							100,000			
Indeno[123cd]pyrene					12,000		93,000			
Naphthalene										
Phenanthrene	1,300				58,000		510,000			
Pyrene	2,100				66,000		460,000			
Volatiles	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics	ŇA	NA	NA	NA	NA	NA	NA	NA	NA	NA

BDL = All constituents analyzed were below laboratory detection limits.

· · · ·

- = Below detection limit.

NA = Not Analyzed.

* = Detection result reported below laboratory EQL.

J = Numerical value is an estimated quantity.

5/19/99

Table 2.6 (continued) Stream Sediment Sampling Results Collected Between 12/97 and 1/98 (all results in ug/kg). The Scotts Company, Marysville, Ohio.

			St	ream Se	diment S	Samplin	g Locati	on		
Compounds	11	12	13	14	15	16	17	18	19	19
										Duplicate
Pesticides										
Chlordane	170	160	240	110	450	590	360	580		
4,4'DDD							*-	230		
4,4'DDT						150		100		
Herbicides										
2,4D										
Semivolatiles						-				
Acenaphthene										
Anthracene		910								
Benzo[a]anthracene		2,300								
Benzo[b]fluoranthene	-	1,700								
Benzo[k]fluoranthene										
Benzo[ghi]perylene				-						
Benzo[a]pyrene		1,300								
Chrysene	-	2,800								
Dibenzofuran									-	
Fluoranthene		5,900								
Fluorene										
Indeno[123cd]pyrene										
Naphthalene		1,900								
Phenanthrene		4,700								
Pyrene		4,800			<u> </u>					
Volatiles	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

BDL = All constituents analyzed were below laboratory detection limits.

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- = Below detection limit.

NA = Not Analyzed.

* = Detection result reported below laboratory EQL.

J = Numerical value is an estimated quantity.

5/19/99

Compound	Units	Sediment 1	Sediment 2	Sediment 3	Sediment 4	Sediment 5	Sediment 6	Sediment 7	Sediment 8	Sediment 9
Arsenic	mg/kg	24	14	6.2	6.1	12	6.9	14	7.1	12
Mercury	mg/kg	0.11	0.28	0.11	0.051	0.027	0.067	0.1	0.098	0.24
pH	S.U.	8.3	8.4	8.6	8.5	8.4	8.8	8.6	8.1	8.7
Total Organic Carbon	mg/kg	3,700	2,200	1,700	4,600	17,000	<1,160	8,000	2,600	3,000
Sulfide Reactivity	mg/kg	NA	<9	NA	NA	NA	<9	NA	<9	NA
Total Alkalinity	mg/kg	NA	1,000	NA	NA	NA	1,200	NA	1,900	NA
Herbicides:										
Dalapon	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2.4-DB	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dicamba	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
2.4-D	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dichloroprob	mg/kg	<0.04	<0.04	<0.04	< 0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Dinoseb	mg/kg	<0.01	<0.01	<0.01	< 0.01	<0.01	<0.01	<0.01	<0.01	<0.01
МСРА	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
MCPP	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Silvex	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
2,4,5-T	mg/kg	<0.04	< 0.04	<0.04	<0.04	<0.04	<0.04	< 0.04	<0.04	< 0.04
Pesticides:							1			
Aldrin	me/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Arochlor 1016	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arochlor 1221	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arochior 1232	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arochlor 1242	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arochlor 1248	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arochior 1254	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arochlor 1260	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
alpha-BHC	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
beta-BHC	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
delta-BHC	mg/kg	<0.20	<0.20	<0,20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
gamma-BHC (Lindane)	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chlordane	mg/kg	6.3	5.0	3.3	1.9	19	1.3	6.7	<1.0	1.1
4.4'-DDD	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
4.4-DDE	mg/kg	< 0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	< 0.30
4,4-DDT	mg/kg	<0.30	<0.30	<0.30	< 0.30	<0.30	< 0.30	< 0.30	< 0.30	<0.30
Dieldrin	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endosulfan I	mg/kg	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Endosulfan II	mg/kg	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	< 0.30	<0.30
Endosulfan sulfate	mg/kg	<0.30	<0.30	<0.30	<0.30	< 0.30	<0.30	<0.30	<0.30	<0.30
Endrin	mg/kg	< 0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Endrin aldehyde	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Heptachlor	mg/kg	<0.30	<0.30	<0.30	<0.30	< 0.30	<0.30	<0.30	<0.30	<0.30
Heptachlor epoxide	mg/kg	<0.30	<0.30	< 0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Methoxychior	mg/kg	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Toxaphene	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Semivolatiles:				I						
Acenaphthene	µg/kg	NA	NA	<410	NA	8,536	NA	<450	NA	NA
Anthracene	μg/kg	NA	NA	524	NA	11,541	NA	<450	NA	NA
Benzo[a]anthracene	µg/kg	NA	NA	1,675	NA	32,285	NA	593	NA	NA
Benzo[b]fluoranthene	μg/kg	NA	NA	1,719	NA	27,759	NA	576	NA	NA
Benzo[k]fluoranthene	µg/kg	NA	NA	1,478	NA	33,547	NA	724	NA	NA
Benzo(g.h.i)perviene	µg/kg	NA	NA	528	NA	7,699	NA	<450	NA	NA
Benzo[a]pyrene	µg/kg	NA	NA	1,407	NA	28,185	NA	605	NA	NA
Chrysene	нв/кв	NA	NA	1,746	NA	30,572	NA	670	NA	NA
Dibenzofuran	µug∕kog	NA	NA	<410	NA	6,477	NA	<450	NA	NA
Fluoranthene	µg/kg	NA	NA	3,576	NA	62,124	NA	1,325	NA	NA
Fluorene	µg/kg	NA	NA	<410	NA	8,284	NA	<450	NA	NA
Indeno[1,2,3-cd]pyrene	µg/kg	NA	NA	585	NA	9,280	NA	<450	NA	NA
Phenanthrene	µg/kg	NA	NA	2,949	NA	59,296	NA	1,011	NA	NA
Рутепе	µg/kg	NA	NA	2,820	NA	54.479	NA	1.264	NA	NA

numbers in **bold** exceed the method detection limit

Compound	Units	Sediment 10	Sediment 11	Sediment 12	Sediment 13	Sediment 14	Sediment 15	Sediment 16	Sediment 17	Sediment 18
Arsenic	mg/kg	9.9	NA	12	9.8	12	11	9.1	4.3	17
Mercury	mg/kg	0.098	0.074	0.16	0.05	0.033	0.034	0.0089	0.0066	0.041
pH	S.U.	8.3	8.6	8.2	8.2	8.4	8.4	8.4	8.4	8.6
Total Organic Carbon	mg/kg	4.000	2,900	4,300	1,900	<1,170	1,200	1,100	4,400	1,400
Sulfide Reactivity	mg/kg	<8	<10	NA	<10	NA	NA	<10	<10	<9
Total Alkalinity	mg/kg	3,000	2,700	NA	1,700	NA	NA	1.700	2,900	3,200
Herbicides:										
Dalapon	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,4-DB	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dicamba	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
2,4-D	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dichloroprob	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Dinoseb	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
МСРА	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
мсрр	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Silvex	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
2,4,5-T	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Pesticides:							ļ		<u> </u>	
Aldrin	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.02
Arochior 1016	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.10
Arochior 1221	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.10
Arochior 1232	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.10
Arochior 1242	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.10
Arochlor 1248	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.10
Arochior 1254	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.10
Arochlor 1260	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.10
aipha-BHC	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.02
beta-BHC	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.02
delta-BHC	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.02
gamma-BHC (Lindane)	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.02
Chlordane	mg/kg	3.8	<1.0	2.0	2.0	2.0	1.7	1.2	1.3	0.16
4,4-DDD	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.02
4,4-DDE	mg/kg	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.03
4,4•DDT	mg/kg	<0.30	<0.30	<0.30	<0,30	<0.30	<0.30	<0.30	<0.30	<0.03
Dreidnn	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.02
Endosuman I	mg/sg	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.03
Endosular II	mg/kg	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.03
Encosultan suitate	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.05
Endin eldebude	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.05
Hentachlor	mg/kg	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.03
Hentechlor sponde	mg/kg	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.03
Methorychior	mg/kg	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.03
Toyanhene	me/kg	<10	<1.0	<10	<10	<1.0	<10	<10	<1.0	<0.03
Semivolatiles:				1		T				
Acmanhtheme	jugArg	NA	NA	<140	NA	NA	< 380	NA NA		NA
Anthraceme	<u> 48/48</u>		NA	<440		NA NA	380		NA	NA NA
Benzolalanthmoene	μ <u>α</u> /κ <u>α</u>	NA NA	NA	<440	NA	NA	<380	NA NA	NA NA	NA
Benzolajanuuacene	<u> </u>		NA NA	<440	NA	NA	380			NA NA
Benzolkifluoranthene	<u> </u>	NA NA	NA NA	<440	NA	NA NA	<380	NA NA	NA NA	NA NA
Benzolg hilpersiene	10/km	NA NA		<440		NA NA	<390	NA NA		NA NA
Benzolehurene	100/km	NA NA	NA NA	<140	NA NA	NA NA	<190	NA NA	NA NA	NA NA
Chrysene	100/km	NA NA	NA NA	<440	NA NA	NA NA	<120		NA NA	NA NA
Dibepzofuran	110/mg	NA NA	NA NA	<1440	NA NA	NA NA	<320		NA NA	NA NA
Fluorenthene	10/ra	NA	NA NA	< <u><440</u>	NA NA	NA NA	<120	NA NA	NA NA	NA NA
Fhorese	HE/NO	NA NA	NA NA	C440	NA NA		< 290	NA NA		
Indepoil 2 3 odlourse	10/kg	NA NA	NA NA	< <u>440</u>	NA NA	NA	< 190	NA NA		
Phenenthtene	up/ca	NA NA	NA NA	CAAD	NA	NA NA	<390	NA NA		NA NA
Pyrene	με/kg	NA	NA	<440	NA	NA	<380	NA	NA	NA

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numbers in **bold** exceed the method detection h

BDL = All constituents were below laboratory detection limits.
- = Below detection limit.
NA = Not Analyzed.
* = Detection result reported below laboratory EQL.
J = Numerical value is an estimated quantity.

Compound	Units	Sediment 19	Sediment 20	Sediment 21	Sediment 22	Sediment 23	Sediment 24a	Sediment 24b	Sediment 24c	Sediment 24d
Arsenic	mg/kg	15	15	16	11	20	NA	NA	NA	NA
Mercury	mg/kg	0.017	0.48	0.017	<0.012	0.097	NA	NA	NA	NA
pH	S.U.	8.6	8.1	8.5	9.1	8.4	NA	NA	NA	NA
Total Organic Carbon	mg/kg	<1,010	<1,020	<1,190	<977	1,200	NA	NA	NA	NA
Sulfide Reactivity	mg/kg	NA	NA	<9	<9	NA	NA	NA	NA	NA
Total Alkalinity	mg/kg	NA	NA	3,500	4,800	NA	NA	NA	NA	NA
Herbicides:										
Dalapon	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,4-DB	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dicamba	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
2,4-D	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dichloroprob	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Dinoseb	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
MCPA	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
MCPP	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Silvex	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
2,4,5-T	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Pesticides:										
Aldrin	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<2.0	<0.20	<0.20	<0.20
Arochlor 1016	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<1.0	<1.0	<1.0
Arochior 1221	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<1.0	<1.0	<1.0
Arochior 1232	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<1.0	<1.0	<1.0
Arochlor 1242	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<1.0	<1.0	<1.0
Arochlor 1248	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<1.0	<1.0	<1.0
Arochior 1254	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<1.0	<1.0	<1.0
Arochlor 1260	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<1.0	<1.0	<1.0
alpha-BHC	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<2.0	<0.20	<0.20	<0.20
beta-BHC	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<2.0	<0.20	<0.20	<0.20
delta-BHC	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<2.0	<0.20	<0.20	<0.20
gamma-BHC (Lindane)	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<2.0	<0.20	<0.20	<0.20
Chlordane	mg/kg	1.6	6.6	2.1	<1.0	6.5	25	2.9	2.5	2.1
4,4*-DDD	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<2.0	<0.20	<0.20	<0.20
4,4'-DDE	mg/kg	<0.30	<0.30	<0.30	<0.30	<0.30	<3.0	<0.30	<0.30	<0.30
4,4'-DDT	mg/kg	<0.30	<0.30	<0.30	<0.30	<0.30	<3.0	<0.30	<0.30	<0.30
Dielann	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<2.0	<0.20	<0.20	<0.20
Endosulian I	mg/kg	<0.30	<0.30	<0.30	<0.30	<0.30	<3.0	<0.30	<0.30	<0.30
Endosullan II	mg/kg	<0.30	0.30	<0.30	<0.30	<0.30	<3.0	<0.30	<0.30	<0.30
Endosulan sulate	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<3.0	<0.50	<0.30	<0.30
Enduin Enduin	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<0.50	<0.50	<0.50
Hantachior	mg/kg	<0.30	<0.30	<0.30	<0.30	<0.30	(3.0	<0.30	<0.30	<0.30
Hentroplet enounde	mg/kg	<0.30	<0.30	<0.30	<0.30	<0.30	3.0	<0.30	<0.30	<0.30
Methorychior	mg/kg	<0.30	<0.30	<0.30	<0.30	<0.30	<3.0	<0.30	<0.30	<0.30
Toxaphene	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<1.0	<10	<1.0
Semiyolatilee			1	1	1	1				
Acenaphthene		NA	<370	NA	NA	684	NA	NA		N.A.
Anthracene	119/kg		<370	NA NA	NA NA	088	NA NA	NA NA	NA NA	NA
Benzolalanthracene	Hg/Ag		<370	NA NA	NA	2 012	NA	NA		NA
Benzoiblfwomnthene	<u>He/wg</u>	NA NA	<370	NA NA		1960	NA	NA		NA
Benzolklfhuoranthene		NA	<370	NA	NA	1,787	NA	NA NA	NA NA	NA
Benzola h ilperviene		NA	<370	NA NA	NA NA	672	NA	NA NA	NA	NA
Benzolalpyrene	110/kcz	NA	<370	NA NA	NA	1.943	NA	NA NA	NA NA	NA NA
Chrysene	ue/ko	NA	<370	NA	NA	2,871	NA	NA NA		NA NA
Dibenzofiran	10/ro	NA	<370	NA NA	NA NA	173	NA NA	NA NA	NA NA	
Fluoranthene	<u> </u>	NA	<370	NA	NA	4,960	NA	NA NA		NA NA
Fhiorene	up/ke	NA NA	<170	NA NA	NA NA	612	NA	NA NA		NA NA
indeno[1,2,3-cd]nyrene	up/ko		<170	NA NA	NA	700	NA NA	NA NA	NA	NA NA
Phenanthrene	up/ko	NA NA	<170	NA NA	NA	4.761	NA NA	NA	NA NA	NA NA
Pyrene	με/kg	NA NA	<370	NA	NA	4,076	NA	NA NA	NA NA	NA NA

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numbers in **bold** exceed the method detection li

Compound	Units	Sediment	Sediment 25h	Sediment	Sediment 25d	Sediment	Sediment	Sediment
Amenic	ma/ka	NA	NA	NA	NA	15	85	17
Mercura	mg/kg	NA	NA	NA	NA	0.065	0.061	0.072
pH	S.U.	NA	NA	NA	NA	8.3	8.1	8.3
Total Organic Carbon	mg/kg	NA	NA	NA	NA	<1,060	<1,250	1,600
Sulfide Reactivity	mg/kg	NA	NA	NA	NA	<10	NA	NA
Total Alkalinity	mg/kg	NA	NA	NA	NA	2,800	NA	NA
Herbicides:								
Dalapon	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,4-DB	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dicamba	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
2,4-D	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dichloroprob	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Dinoseb	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
МСРА	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
МСРР	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Silvex	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
2,4,5-T	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Pesticides:								
Aldrin	mg/kg	<0.20	<0.20	<0.20	<0.20	<2.2	<0.20	<0.20
Arochlot 1016	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arochior 1221	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arochlor 1232	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arochlor 1242	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arochlor 1248	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arochlor 1254	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arochlor 1260	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
alpha-BHC	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
beta-BHC	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
delta-BHC	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
gamma-BHC (Lindane)	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chlordane	mg/kg		10	33	11	4.4	1.5	6.0
4,4-DDD	mg/sg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
4,4-DDE	mg/sg	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
	mg/sg	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Endosulfan I	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endosulfan II	mg/kg	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Endosulfan sulfate	me/ke	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Endrin	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Endrin aldehyde	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Heptachlor	me/kg	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Heptachior epoxide	mg/kg	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Methoxychlor	mg/kg	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Toxaphene	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Semivolatiles:				1			I	
Acenaphthene	ug/kg	NA	NA	NA	. NA	NA	<390	NA
Anthracene	ue/ke	NA	NA	NA	NA	NA NA	<390	NA
Benzojalanthracene	μ <u>ε</u> /κα	NA	NA	NA	NA	NA	<390	NA
Benzolblfhuoranthene	με/κε	NA	NA	NA	NA	NA	<390	NA
Benzo[k]fluoranthene	μ <u>ε</u> /κε	NA	NA	NA	NA	NA	<390	NA
Benzo[g,h,i]perviene	µg/kg	NA	NA	NA	NA	NA	<390	NA
Benzo[a]pyrene	µg/kg	NA	NA	NA	NA	NA	<390	NA
Chrysene	µg/kg	NA	NA	NA	NA	NA	<390	NA
Dibenzofuran	µg/kg	NA	NA	NA	NA	NA	<390	NA
Fluoranthene	µg/kg	NA	NA	NA	NA	NA	<390	NA
Fluorene	µg/kg	NA	NA	NA	NA	NA	<390	NA
indeno[1,2,3-cd]pyrene	µg/kg	NA	NA	NA	NA	NA	<390	NA
Phenanthrene	µg/kg	NA	NA	NA	NA	NA	<390	NA
Pyrene	µg/kg	NA	NA	NA	NA	NA	<390	NA

numbers in **beld** exceed the method detection li

BDL = All constituents were below laboratory detection limits. BOL - All consumers were below laboratory detect
 - = Below detection limit.
 NA = Not Analyzzd.
 * = Detection result reported below laboratory EQL.
 J = Numerical value is an estimated quantity.

	Г		SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-2	SW-2	SW-2	SW-2	SW.2	SW.2	SW.2	SW-1
Value Organic Compounds up	PARAMETER NAME	UNITS	11/19/96	2/10/97	5/20/97	8/27/97	11/19/97	2/26/98	6/23/98	11/19/96	2/10/97	5/20/97	8/27/97	11/19/97	2/26/98	6/23/98	11/19/96
Actes uppl Status value value <th< th=""><th>Volatile Organic Compounds</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></th<>	Volatile Organic Compounds																
Shatamote ugf n <th< td=""><td>Acetone</td><td>ug/l</td><td><100</td><td>NA</td><td><2</td><td><2.00</td><td><20</td><td><20</td><td><20</td><td><100</td><td>NA</td><td><2</td><td>3.20</td><td><20</td><td><20</td><td><20</td><td><100</td></th<>	Acetone	ug/l	<100	NA	<2	<2.00	<20	<20	<20	<100	NA	<2	3.20	<20	<20	<20	<100
	2-Butanone	ug/l															
Methylene hondrie wigh c3 NA c1 0.53 NA c1 0.53 c1.0	Chioroform	ug/l															
Table up/1 n<	Methylene chloride	ug/l	<5	NA	<1	0.422*	<1.0	<1.0	<1.0	<5	NA	<1	0.542*	<1.0	<1.0	<1.0	<5
Stath Metall Deparke Campons valid valid <th< td=""><td>Toluene</td><td>ug/l</td><td></td><td></td><td></td><td>••</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>•-</td><td></td><td></td><td></td></th<>	Toluene	ug/l				••								•-			
	Semi-Volatile Organic Compounds		<u> </u>			···· · · · · · · · · · · · · · · · · ·	-·						···				
	Benzolk fluoranthene	uc/1															
bis (2-) inplanalation bis (2-) inplanalatio	Benzolg, h. Hpervlene	5 ug/l]														
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	bis (2-Ethylbexyl) phthalate	uc/l		<11	<6.0	<6.0	<2.0	2.5	<2.0	<12	<11	<6.0	0.90*	<2.0	<2.0	<2.0	<10
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Chrysene	uc/1															
Financial free upp int int< int< int< int< int< int int int<	Di-n-butylobthalate	ue/l	<11	<11	<10	<10	<10	<1.0	<1.0	<12	<11	<10	0.17*	<1.0	<10	<1.0	<10
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Fluoranthene	ug/1			<10			<1.0	<1.0		N	<10	0.17	×1.0	N1.0	N1.0	<10 ⁻
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Indepo(1.2.3. cd)purepe	ug/1								•-							
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Dhannathrong	ug/1												••			
typete ug/l n	Prinemanthrene	ug/i	- I		•			••									
Predictions	Pyrene	ug/I													••		
Aldrin ug/l	Pesticides														·····		
upbe BHC upf <td>Aldrin</td> <td>ug/l</td> <td></td>	Aldrin	ug/l															
delta-BHC ug/l c002	alpha-BHC	ug/l															
$ \begin{array}{c} \mbox{Tech} (-blordane \ upf \ 0.20 \ c$30 \ c$2.5 \ c$3.0 \ c$2.5 \ c$3.0 \ c$	delta-BHC	ug/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	(Tech) Chlordane	ug/l	<0.20	<5.0	<2.5	<0.200	<0.10	<0.10	<0.10	<0.20	<5.0	<2.5	<0.200	<0.10	<0.10	<0.10	<0.20
44*ODE ug/l < 0.10 < 0.60 < 0.10 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0.03 < 0	4,4'-DDD	ug/l	<0.10	<0.60	<0.10	<0.100	<0.02	<0.02	<0.02	<0.10	<0.60	<0.10	<0.100	<0.02	<0.02	<0.02	<0.10
4A-DDT ug7 <	4.4'-DDE	ug/1	<0.10	<0.60	<0.10	<0.100	<0.03	< 0.03	<0.03	<0.10	<0.60	<0.10	<0.100	<0.03	<0.03	<0.03	<0.10
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	4.4'-DDT	ug/1															
Imprint ug/l	Dieldrin	ug/l															
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Endrin	ng/l															
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Endosulfan I	ue/i	l	 ,													
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Endosulfan II	ug/1															
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		ug/t										••					
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		ug/1		••													
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		ugn		••				••							••		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Herbleides																
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	2,4-D	ug/l	<0.10	<7.0	4.0	<4.0	<0.10	<0.10	<0.10	<0.10	<7.0	5.1	<4.0	0.42	<0.20	<0.10	12.0
Dicambaug/l<0.20<10<0.099<2.0<0.20<0.20<0.20<100.66<2.0<0.20<0.20<0.202.5Inorganicsug/lug/l<10 6.7 <1<5.0 3.6 <3.0<3.0<10 5.7 <1<50 4.5 <0.3<3.0<10Arsenicug/l<5<5<1.0<5.0<3.0<3.0<3.0<5<5<1.0<50 4.7 <0.3<3.0<5Bariumug/l100<10043<5.3 69 42 65 140<100 43 <20152<0 48 <100Berylliumug/l0.5<0.5<0.25<1.0<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<	2,4-DB	ug/l					<0.10	<0.10	<0.10					<0.10	<0.10	<0.10	
InorganicsAntimony ug/l <10	Dicamba	ug/l	<0.20	<10	<0.099	<2.0	<0.20	<0.20	<0.20	<0.20	<10	0.66	<2.0	<0.20	<0.20	<0.20	2.5
Antimonyug/l<10 6.7 <1<5.0 3.6 < 3.0 < 3.0 < 10 5.7 <1<50 4.5 < 0.3 < 3.0 <10Arsenicug/l<5<5<1.0<50< 3.0 < 3.0 < 3.0 < $c3.0$ < $c3.0$ < $c5$ < $c5$ < $c1.0$ < $c50$ 4.5 < $c0.3$ < $c3.0$ < $c10$ Arsenicug/l100<100 43 <53.8 69 42 65 140<100 43 < $c20$ 152<50 48 <100Berylliumug/l0.5<0.5<0.25<1.0<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5<0.5	Inorganics									•							
Arsenic ug/l <5 <5 <1.0 <5.0 <3.0 <3.0 <3.0 <5 <5 <1.0 <50 4.7 <0.3 <3.0 <5 Barium ug/l 100 <100	Antimony	ug/l	<10	6.7	<1	<5.0	3.6	<3.0	<3.0	<10	5.7	<1	<50	4.5	<0.3	<3.0	<10
Barium ug/l 100 <100 43 53.8 69 42 65 140 <100 43 <20 152 50 48 <100 Beryllium ug/l 0.5 <0.5 <0.25 <1.0 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5	Arsenic	ug/1	<5	<5	<1.0	<5.0	<3.0	<3.0	<3.0	<5	<5	<1.0	<50	4.7	<0.3	<3.0	<5
Beryllium ug/l 0.5 <0.5 <0.25 <1.0 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5	Barium	ug/l	100	<100	43	53.8	69	42	65	140	<100	43	<20	152	50	48	<100
Cadmium ug/l <1 NA <0.25 <1.0 <0.5 <0.5 <1 NA <0.25 <10 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.	Beryllium	ug/l	0.5	<0.5	<0.25	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.25	<10	<0.5	<0.5	<0.5	<0.5
Calcium mg/l 160 NA 49.7 78.8 NA NA NA 240 NA 66.1 136 NA NA NA 150 Chromium ug/l <2	Cadmium	ug/1	<1	NA	<0.25	<1.0	<0.5	<0.5	<0.5	<i< td=""><td>NA</td><td><0.25</td><td><10</td><td><0.5</td><td><0.5</td><td><0.5</td><td><1</td></i<>	NA	<0.25	<10	<0.5	<0.5	<0.5	<1
Ug/l <2 <2 <3 <10 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20	Calcium	mg/i	160	NA	49.7	78.8	NA	NA	NA	240	NA	66.1	136	NA	NA	NA	150
Cobalt ug/l <100 <100 <10 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <t< td=""><td>Chromium</td><td>11g/l</td><td><2</td><td><2</td><td><3</td><td><10</td><td><20</td><td><20</td><td><20</td><td><2</td><td><2</td><td><3</td><td><100</td><td><20</td><td><20</td><td><20</td><td><2</td></t<>	Chromium	11g/l	<2	<2	<3	<10	<20	<20	<20	<2	<2	<3	<100	<20	<20	<20	<2
Copper ug/l <20 NA 5.0 <10 NA NA ×20 NA 4 <100 NA NA ×20 Iron ug/l 46 NA 0.557 <50 NA NA NA 300 NA 0.129 <500 NA NA NA <20 Iron ug/l 46 NA 0.557 <50 NA NA NA 300 NA 0.129 <500 NA NA A 60 Lead ug/l <2 NA <1.0 <5.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0 <2.0	Cobalt	ue/l	<100	<100	<10	<5.0	NA	NA	NA	<100	<100	<10	<50	NA	NA	NA	<100
ug/l 46 NA 0.0 100 <td>Conper</td> <td>nø/</td> <td><20</td> <td>NA</td> <td>50</td> <td><10</td> <td>NA</td> <td>NA</td> <td>NA</td> <td><20</td> <td>NA</td> <td>4</td> <td><100</td> <td>NA</td> <td>NA</td> <td>NA</td> <td><20</td>	Conper	nø/	<20	NA	50	<10	NA	NA	NA	<20	NA	4	<100	NA	NA	NA	<20
ugi to its its <td>Iron</td> <td>ue/</td> <td>46</td> <td>NA</td> <td>0 447</td> <td>~50</td> <td>NA</td> <td>NA</td> <td>NA NA</td> <td>300</td> <td>NA NA</td> <td>0 1 20</td> <td>~100</td> <td>NA NA</td> <td>NA NA</td> <td>NA</td> <td><u>40</u></td>	Iron	ue/	46	NA	0 447	~50	NA	NA	NA NA	300	NA NA	0 1 20	~100	NA NA	NA NA	NA	<u>40</u>
Leau ugi 22 m 51.0 53.0 52.0 52.0 52.0 52.0 52.0 52.0 52.0 52	Lead	ug/1		NA	<10	~50	~20	~20	~20	-2	NA	<1.0	<50	~2.0	~2.0	~2.0	-2
	Magnesium	ma/l	20	NA NA	14 4	210	NA	NA	NA	62	NA	26.2	444	<4.U NA	NA	NA	<2 <<

NA = Not Analyzed

-- = Not Detected

NM = Not Measured

* = Result below lab EQL

·		SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	<u>SW-1</u>	<u>SW-2</u>	SW-2	SW-2	SW-2	<u>SW-2</u>	SW-2	SW-2	SW-3
PARAMETER NAME	UNITS	11/19/96	2/10/97	5/20/97	8/27/97	11/19/97	2/26/98	6/23/98	11/19/96	2/10/97	5/20/97	8/27/97	11/19/97	2/26/98	6/23/98	11/19/96
Inorganics (continued)																
Manganese	ug/l	19	21	17	<5.0	NA	NA	NA	1000	62	40	83	NA	NA	NA	35
Mercury	ug/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nickel	ug/l	<40	<40	<3	<10	<20	<20	<20	47	<40	<3	<100	<20	<20	<20	<40
Potassium	mg/l	12	3.6	NA	<5.0	NA	NA	NA	32	7.4	NA	20.0	NA	NA	NA	12
Selenium	ug/l	<5	NA	<1.0	<5.0	<15.0	<3.0	<3.0	<5	NA	<1.0	<50	<15.0	<3.0	<15.0	<5
Silver	ug/l	<50	NA	<1.0	<5.0	NA	NA	NA	<50	NA	<1.0	<50	NA	NA	NA	<50
Sodium	mg/l	210	NA	18.2	28.7	NA	NA	NA	320	NA	39.5	225	NA	NA	NA	110
Thallium	ug/l	<1.5	NA	<1.0	<1.2	<1.0	<1.0	<1.0	<1.5	NA	<1.0	<12	<1.0	<1.0	<1.0	<1.5
Vanadium	`mg/l	<1	NA	< 0.003	<0.010	NA	NA	NA	<1	NA	<0.003	<0.10	NA	NA	NA	<1
Zinc	ug/l	<10	NA	<5	<20	<10	<10	<10	23	NA	<5	<200	26	<10	<10	16
Miscellaneous					·····											
Ammonia	mg/l	0.3	0.2	<1.5	<1.5	0.27	0.16	<0.05	1.9	<0.2	<1.5	<1.5	0.87	0.06	0.29	
Nitrate/Nitrite	mg/l	12	27	15.4	7.42	1.58	9.49	16.3	0.14	6.2	10.8	1.22	1.47	7.16	1.57	9.2
Phosphorus, Total	mg/l	0.15	<0.02	0.118	0.0450	NA	NA	NA	0.7	0.03	0.226	0.224	NA	NA	NA	0.61
Water Quality Parameters	<u>. </u>	[·										
pН	S.U.	NM	7.4	8.04	9.20	8.03	8.05	8.75	NM	7.2	8.20	7.38	7.48	8.15	7.93	NM
Temperature	°C	NM	2	16.3	19.8	5.5	8.6	26.2	NM	2	22.4	19.6	4.4	9.2	22.2	NM
Conductivity	umhos/cm	NM	660	520	587	767	642	682	NM	900	753	1,350	5,510	1,010	781	NM



		SW.3	SW.3	SW.3	SW-3	SW.3	SW-3	OMS-SW-01	OMS-SW-06	OMS-SW-12	OMS-SW-14	CR-1	CR.2	CR-2 (dup)
PARAMETER NAME	UNITS	2/10/97	5/20/97	8/27/97	11/19/97	2/26/98	6/23/98	Dec. 1994	Dec. 1994	Dec. 1994	Dec. 1994	Aug. 1997	Aug. 1997	Aug. 1997
Volatile Organic Compounds														
Acetone	ug/l	NA	3.7	<2.00	<20	<20	<20					NA	NA	NA
2-Butanone	ug/l	I						13		13	13	NA	NA	NA
Chloroform	ug/l													
Methylene chloride	ug/l	NA	2.3	0.480*	<1.0	<1.0	<1.0					NA	NA	NA
Toluene	ug/l				•-	••		6.1		6.1	6.1	NA	NA	NA
Semi-Volatile Organic Compounds					•		• •							
Benzo[k] fluoranthene	ug/l										·			
Benzolg,h,l perylene	i∿ ug/l													
bis (2-Ethylhexyl) phthalate	ug/1	<10	<6.0	0.34*	<2.0	<2.0	<2.0					NA	· NA	NA
Chrysene	ug/l													
Di-n-butylphthalate	ug/l	<10	<10	<10	<1.0	<1.0	<1.0					NA	NA	NA
Fluoranthene	ug/l													
Indeno(1,2,3-cd)pyrene	ug/1													
Phenanthrene	ug/l			۰										
Pyrene	ug/l												••	
Pesticides							·	· · · · · ·	-,					
Aldrin	ug/l									0.07				0.05 J
alpha-BHC	ug/l													
delta-BHC	ug/l	<0.02	<0.02	<0.02	<0.02	<0.02	0.32							0.037 J
(Tech) Chlordane	ug/1	<5.0	<2.5	0.250	<0.10	<0.10	<0.10							0.82 J
4.4'-DDD	ug/l	<0.60	<0.10	0.0120*	<0.02	<0.02	<0.02							0.046 J
4.4'-DDE	us/t	<0.60	<0.10	0.0400*	< 0.03	<0.03	<0.03							
4.4'-DDT	uɛ/l													0.28 J
Dieldrin	ue/l													
Endrin	ue/l							0.100			0.100			
Endosulfan I	ug/1													0.066.1
Endosulfan II	ug/1							0.260			0.260			
Hentachlor	110/1				· ·						0.05			
Heptachlor epoxide	ug/t							0.070			0.050			
Herbicides									·					·
2.4-D	ue/l	<7.0	5.6	<4.0	<0.10	1.1	<0.10	62	4.6		15	NA	NA	NA
2.4-DB	ue/l				9.5	<0.10	<0.10					NA	NA	NA
Dicamba	ug/l	<10	0.61	<2.0	1.0	<0.20	<0.20					NA	NA	NA
Inorganics										·····				
Antimony	ug/l	7.1	<1	<5.0	3.8	<3.0	<3.0					NA	NA	NA
Arsenic	ug/l	<5	2	<5.0	4.6	<3.0	5.2					NA	NA	NA
Barium	ue/1	<100	46	55.2	49	55	54					NA	NA	NA
Beryllium	u£/1	<0.5	<0.25	<1.0	<0.5	<0.5	<0.5				••	NA	NA	NA
Cadmium	ue/1	NA	<0.25	<1.0	<0.5	<0.5	<0.5					NA	NA	NA
Calcium	mg/J	NA	61.8	89.3	NA	NA	NA					NA	NA	NA
Chromium	ue/1	<2	<3	<10	<20	<20	<20					NA	NA	NA
Cobalt	ue/1	<100	<1.0	<5.0	NA	NA	NA					NA	NA	NA
Copper	ue/l	NA	8	<10	NA	NA	NA					NA	NA	NA
iron	ue/l	NA	0.247	80	NA	NA	NA				••	NA	NA	NA
Lead	ue/l	NA	<1.0	<5.0	<2.0	<2.0	<2.0					NA	NA	NA
Magnesium	mg/l	NA	18.8	26.1	NA	NA	NA					NA	NA	NA

NA = Not Analyzed

-- = Not Detected

NM = Not Measured

* = Result below lab EQL

· · · · · · · · · · · · · · · · · · ·	1	C11/ 2	SW 3	CW 1	SW 3	CW 2	CW 2	OME EW AL	OME EW AG	OME EW 12	OME EW 14	CPI	CD1	CD 1(dup)
		514-5	311-3	3	311-5	311-3	311-3	0113-314-01	01413-344-00	DW13-3W-14	0113-341-14	<u> </u>	CK-2	CK-2 (uup)
PARAMETER NAME	UNITS	2/10/97	5/20/97	8/27/97	[]/]9/97	2/26/98	6/23/98	Dec. 1994	Dec. 1994	Dec. 1994	Dec. 1994	Aug. 1997	Aug. 1997	Aug. 1997
Inorganics (continued)														
Manganese	ug/l	47	65	59.5	NA	NA	NA					NA	NA	NA
Mercury	ug/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	•-				NA	NA	NA
Nickel	ug/l	<40	<3	<10	<20	<20	<20					NA	NA	NA
Potassium	mg/l	6.9	NA	10.8	NA	NA	NA					NA	NA	NA
Selenium	ug/l	NA	<1.0	<5.0	<15.0	<3.0	<3.0					NA	NA	NA
Silver	ug/l	NA	<1.0	<5.0	NA	NA	NA					NA	NA	NA
Sodium	mg/l	NA	29.2	60.5	NA	NA	NA					NA	NA	NA
Thallium .	ug/l	NA	<1.0	<1.2	<1.0	<1.0	<1.0					NA	NA	NA
Vanadium	_mg/l	NA	<0.003	<0.010	NA	NA	NA		. 			NA	NA	NA
Zinc	`ug/l	NA	9	49	41	23	31		••			NA	NA	NA
Miscellaneous														
Ammonia	mg/l	3.6	7.56	3.64	22.7	5.15	25.6					NA	NA	NA
Nitrate/Nitrite	mg/l	13	14.9	<0.20	16.3	10.1	25.7					NA	NA	NA
Phosphorus, Total	mg/l	0.18	0.400	0.520	NA	NA	NA					NA	NA	NA
Water Quality Parameters									····					
рН	S.U .	7.2	7.33	7.12	7.07	8.32	7.81	NA	NA	NA	NA	NA	NA	NA
Temperature	"C	I	15.5	17.5	3.6	7.9	23	NA	NA	NA	NA	NA	NA	NA
Conductivity	umhos/cm	880	715	1,790	1,940	913	1,073	NA	NA	NA	NA	NA	NA	NA

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Table 2.7 Surface Water Analytical Results. The Scotts Company, Marysville, Ohio.

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		Crosses Run RM 2.8	Crusses Run RM 2.0	Crosses Run RM 0.8	North Branch Crosses Run RM 0.9	North Branch Crosses Run RM 0.1
PARAMETER NAME	UNITS	Summer 1995	Summer 1995	Summer 1995	Summer 1995	Summer 1995
Volatile Organic Compounds						
Acetone	ug/l					
2-Butanone	ug/l					
Chloroform	ug/l		2.3			
Methylene chloride	ug/l					
Toluene	ug/l			·		
Semi-Volatile Organic Compounds	<u> </u>		<u></u>			
Benzo(k) fluoranthene	ug/l		5.9			7.0
Benzo[g,h,l]perylene	ug/l		2.1			2.1
bis (2-Ethylhexyl) phthalate	`ug/l					
Chrysene	ug/l		2.6			3.9
Di-n-butylphthalate	ug/l					
Fluoranthene	ug/l		4.1			5.9
Indeno(1,2,3-cd)pyrene	ug/l		3.1			3.1
Phenanthrene	ug/l		4.3			3.4
Pyrene	ug/l		2.9			4.0
Pesticides					······································	
Aldrin	ug/l			0.034	0.023	
alpha-BHC	ug/l	0.01			0.015	
delta-BHC	ug/l	0.002	0.128			
(Tech) Chlordane	ug/l					
4,4'-DDD	ug/l		0.014			
4,4'-DDE	ug/l					0.067
4,4'-DDT	ug/l					
Dieldrin	ug/l		0.16		0.003	0.103
Endrin	ug/l			0.011		0.027
Endosulfan I	ug/i				0.009	
Endosulfan II	ug/l		0.005		0.004	0.017
Heptachlor	ug/l				0.003	
Heptachlor epoxide	ug/l	0.004		0.005		
Herbicides						
2,4-D	ug/l	NA	NA	NA	NA	NA
2,4-DB	ug/l	NA	NA	NA	NA	NA
Dicamba	ug/l	NA	NA	NA	NA	NA
Inorganics						
Antimony	ug/l	NA	NA	NA	NA	NA
Arsenic	ug/l	NA	NA	NA	NA	NA
Barium	ug/l	NA	NA	NA	NA	NA
Beryllium	ug/l	NA	NA	NA	NA	NA
Cadmium	ug/l	NA	NA	NA	NA	NA
Calcium	mg/l	NA	NA	NA	NA	NA
Chromium	ug/l	NA	NA	NA	NA	NA
Cobalt	ug/l	NA	NA	NA	NA	NA
Copper	ug/l	NA	NA	NA	NA	NA
iron	ug/l	NA	NA	NA	NA	NA
Lead	ug/l	NA	NA	NA	NA	NA
Magnesium	mg/l	NA	NA	NA	NA	NA

NA = Not Analyzed

-- = Not Detected

NM = Not Measured

* = Result below lab EQL

5/17/99

		Crosses Run RM 2.8	Crosses Run RM 2.0	Crosses Run RM 0.8	North Branch Crosses Run RM 0.9	North Branch Crosses Run RM 0.1
PARAMETER NAME	UNITS	Summer 1995	Summer 1995	Summer 1995	Summer 1995	Summer 1995
Inorganics (continued)						
Manganese	ug/l	NA	NA	NA	NA	NĂ
Mercury	ug/l	NA	NA	NA	NA	NA
Nickel	ug/l	NA	NA	NA	NA	NA
Potassium	mg/i	NA	NA	NA	NA	NA
Selenium	ug/l	NA	NA	NA	NA	NA
Silver	ug/l	NA	NA	NA	NA	NA
Sodium	mg/l	NA	NA	NA	NA	NA
Thallium	ug/l	NA	NA	NA	NA	NA
Vanadium	mg/l	NA	NA	NA	NA	NA
Zinc	`ug∕l	NA	NA	NA	NA	NA
Miscellaneous	1					
Ammonia	mg/l	NA	NA	NA	NA	NA
Nitrate/Nitrite	mg/l	NA	NA	NA	NA	NA
Phosphorus, Total	mg/l	NA	, NA	NA	NA	NA
Water Quality Parameters						
pH	S.U .	NA	NA	NA	NA	NA
Temperature	°C	NA	NA	NA	NA	NA
Conductivity	umhos/cm	NA	<u>NA</u>	NA	NA	NA

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Table 2.7 Surface Water Analytical Results. The Scotts Company, Marysville, Ohio.

Section 2 Figures

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N. Na K

THE IMAGES FOR THE FOLLOWING **DRAWINGS LABELED** FIGURES NO. 2-2 **THROUGH 2.9 SHOW ONLY THE RIGHT HALF OF EACH DRAWING. SEE THE CONSENT ORDER BINDER FOR** THE FULL DRAWINGS.














	THE SCOTTS COMPANY MARYSVILLE, OHIO								
N	RCRA FACILITY INVESTIGATION WORK PLAN								
True North	FORMER PONDS 2, 3 & 6								
	5 AL	Sci	ence Applicational Corpo	ions pration Col	umbus, Ohio				
PET	DRAWN RTB	DATE 3-31-99	SCALE AS SHOWN	PROJECT NO. 00-3361	FIGURE NO. 2.9				

ł Martin Britain . ۰. Section 3 OBJECTIVES

OBJECTIVES OF THE INVESTIGATION

SECTION 3

RCRA FACILITY INVESTIGATION WORK PLAN

FOR

THE SCOTTS COMPANY 14111 Scottslawn Road Marysville, Ohio 43041

1)

June 11, 1999

3.0 OBJECTIVES OF THE INVESTIGATION

This document is the Work Plan for the RFI to be conducted at the Scotts facility. The purpose of an RFI is to "...evaluate thoroughly the nature and extent of the releases or threat of release of hazardous waste and hazardous constituents at a hazardous waste facility." (Ohio EPA, 1997). In addition, the data collected during the RFI must be of sufficient quantity and quality to support subsequent stages of the Corrective Action program, such as the Corrective Measures Study (CMS) and Corrective Measures Implementation (CMI).

The objective of the RFI Work Plan is to define the processes and procedures to be followed in order to identify the presence, magnitude, extent, direction and rate of movement of any past onsite releases of RCRA regulated waste. In order to meet this objective, this RFI Work Plan has been developed in accordance with the Ohio EPA Corrective Action Program guidance.

The specific objectives for the RFI at the Scotts facility are listed below:

- Conduct an investigation building upon the results of the previous studies at the facility to provide an assessment and evaluation of the nature and extent of releases or threatened releases of hazardous wastes or constituents at the Scotts facility;
- Determine the existence of localized shallow saturated zones in the downgradient investigative units (IU);
- Evaluate the IUs impact to the localized shallow saturated zones, if such downgradient zones are identified;
- Determine the nature and extent of concentrations of contaminants of concern in the Crosses Run surface water and the stream sediment;
- Determine background concentrations of constituents in the on-site soils; and
- Determine the extent of the footprint of the two field broadcast areas and Landfill 3 AND 5 by collecting surface and subsurface soil samples.
- Determine the depth and moisture content of waste in the former landfills and ponds specified in this work plan.
- Conduct geotechnical testing of waste and underlying natural material in each of the landfills and ponds.

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Section 4 SAMPLING PLAN Ć •) E.

FIELD SAMPLING PLAN

SECTION 4

RCRA FACILITY INVESTIGATION WORK PLAN

FOR

THE SCOTTS COMPANY 14111 Scottslawn Road Marysville, Ohio 43041

June 11, 1999 (Revised March 21, 2000)

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Background Soil Sample Well Construction Detail

Figure 4.8 Figure 4.9

APPENDIX

Appendix 4A Field Technical Procedures

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4.0 FIELD SAMPLING PLAN

This Field Sampling Plan (FSP) defines the procedures to be implemented in the field during the RFI. This plan describes where, how, and from what environmental media samples will be collected. In addition to sample descriptions, the FSP also defines other types of environmental data to be collected during the RFI. The basis for choosing the number and location of samples is presented in this section.

Much of the work necessary to complete an RFI of the investigative units (IU) has already been conducted at the Scotts facility. The previous investigations that have been conducted on site have made it possible to narrow the focus of this RFI. The objectives of the proposed field activities are to:

- Determine the existence of localized shallow groundwater in the downgradient sides of the IUs;
- If a shallow groundwater zone does exist downgradient to an IU then evaluate the IUs impact to the shallow groundwater zone;
- Determine the nature and extent of concentrations of parameters of concern in the stream water and the stream sediment;
- Determine background concentrations of constituents in the on site soils and the regional upper most saturated zone;
- Determine the extent of the footprint of the two field broadcast areas (FBAs) and Landfills 3 and 5;
- Determine the depth and moisture content of the waste/sediment material in the uncapped landfills and ponds being investigated;
- Conduct geotechnical characterization of the waste fill, sediments, and underlying native materials in each of the landfills and ponds being investigated;
- Continue to delineate the upgradient and downgradient properties of the regional upper most saturated zone.

4.1 INVESTIGATIVE ACTIVITIES

The thirteen investigative units (IU) (including Crosses Run) will be addressed in this FSP. Table 4.1 summarizes the planned sampling activities for each IU. Several different sampling types and techniques will be used to further assess the site. Hand augering, direct push technology (DPT) borings, monitoring well installation and sampling, surface soil samples, surface water and sediment sampling will be employed in the RFI. In addition, a series of field parameters will to be collected during the various sampling events.

The following tasks will be conducted during this RFI:

- Completion of twenty-eight (28) DPT borings to 1) collect TCLP samples, 2) collect geotechnical samples from waste/sediment fill and underlying native soils, 3) investigate the saturated conditions of the waste/sediment fill, 4) determine depth of waste/sediment fill, 5) and investigate the localized shallow groundwater around selected IUs;
- Installation of five (5) groundwater monitoring wells (screened in the regional upper most saturated zone) in the vicinity of the IUs and in background locations;

- Hand augers will be advanced at fifteen (15) locations at Landfills 2, 3, and 5. These hand augers are to determine the lateral extend of these landfills.
- Possible installation of nine (9) groundwater monitoring wells (screened in the localized shallow saturated zones) based on the results of the DPTs;
- Test pit excavations will be conducted near the edges of the investigative units, primarily at the landfills, to delineate the lateral and horizontal extent of material.
- Collection of twenty-two (22) surface water samples and thirty-two (32) sediment samples along Crosses Run and four surface water and sediment samples in Mill Creek;
- Collection of twelve (12) background surface soil samples;
- Collection of fourteen (14) surface soil samples on the two FBAs;
- Collection of twenty-one (21) surface soil samples on Former Ponds 2, 3, 6, 7, and 8;
- Collection of twenty-two (22) subsurface samples within the five (5) former ponds and FBA 2
- Conduct slug testing on all new groundwater monitoring wells.

The descriptions of the geologic settings at each IU are derived from the detailed discussion presented in Section 2.1.2.2 (Local Geology). The glacial deposits can be divided into two generalized units. From the surface to approximately 20 feet below ground surface (bgs) (950 feet above mean sea level [amsl]), the glacial deposits consist mainly of clay rich till, with some vertical fracturing. Below 20 feet, the clay till material is still predominant. However, layers of sand and gravel are typically present below 20 feet from the surface. The stratigraphic position of these sandy layers is variable, and there is no indication that they are laterally extensive. In this depositional setting, numerous thin discontinuous sand and gravel layers are possible with many of the deposits truncated by subsequent glacial advances and outwashes.

In some of the borings advanced on the Scotts property, sporadic, very thin seams of saturated sand or sand and gravel have been encountered in the shallow zone within 20 feet of the surface. Static groundwater surface measurements of these shallow seams indicate they are not hydrologically connected to other shallow seams, nor to the deeper, more pervasive saturated zone. In the following discussion the saturated seams encountered in the shallower unit are referred to as the "localized shallow saturated zones", and the saturated seams in the deeper unit are referred to as the "regional upper most saturated zone".

4.1.1 Landfill 1

Landfill 1 is located west of the railroad tracks, and south of the north branch of Crosses Run, in the northwest portion of the Scott's property. The limit of waste for Landfill 1 is shown on Figure 4.1. In August 1998, an interim action was conducted which involved the final closure of Landfill 1. A more detailed description of Landfill 1 is presented in Section 2.4.1 of this document.

Additional investigation to characterize the localized shallow saturated zones and fracturing of the glacial till in the downgradient side of Landfill 1 is considered unnecessary. The groundwater flow direction as measured in the regional upper most saturated zone in the vicinity Landfill 1 is to the south-by-southeast. Immediately to the south of Landfill 1 are settling Ponds 5, 5A, 4 and 4A. They are scheduled to be closed and are currently undergoing pre-closure activities which include the removal of the settled material. Once all of the material has been removed then the pond's metal tub enclosures will be removed and the depressions backfilled with clay and compacted. The pond closures and the Landfill 1 closure, as described in Section 2.4.1, is anticipated to severally disrupt or obliterate any shallow hydrogeological features which may have existed here.

Instead of a south-by-southeast flowing localized shallow saturated zone existing in the vicinity of Landfill 1, an artificial, near-surface perched groundwater zone may be flowing back towards the stream from Landfill 1. The perched groundwater may be flowing through the construction fill material and on top of the relatively impermeable till down the slope (the surface elevation drops approximately 12 feet from the base of the Landfill 1 to Crosses Run). For this reason it is proposed that two (2) DPTs be advanced in the locations shown on Figure 4.1. One DTP will be advanced on the west side of the railroad tracks between Landfill 1 (outside the limits of fill) and Crosses Run. The DPT will be located so that Pond 3 water does not interfere with perched zones that may be sourced from Landfill 1 groundwater migration. The other DPT will be advanced east of the railroad tracks from Landfill 1. This DPT should intercept any potential contaminant migration that may be flowing, first, on the fill/till interface, and then, transferred into a localized shallow saturated zone (if in existence here). If shallow saturated zones are encountered in the DPTs then a monitoring well will be advanced in the DPT location that shows the most significant groundwater.

The semiannual groundwater monitoring currently being conducted will include the monitoring well proposed at Landfill 1, if it is installed. However, the semiannual groundwater monitoring is not within the scope of this RFI work plan.

4.1.2 Landfill 2

Landfill 2 is located in the east-southeast corner of the Scotts property, southwest of Industrial Parkway and southeast of Scottslawn Road. Twenty (20) borings were advanced in the area of Landfill 2 during waste delineation activities (Burgess & Niple, 1998b). A 10.4-feet thickness of waste was encountered at boring b-18 near the western edge of the landfill (Figure 4.2). Waste was reported as saturated at a depth of approximately 5 to 7 feet below ground surface (bgs). Crosses Run is located along the east and south boundaries of the landfill. A detailed description of Landfill 2 is presented in Section 2.4.2.

The groundwater flow direction in the vicinity of Landfill 2 is to the southeast. The three existing monitoring wells (MW-22, MW-23, and MW-24) and the soil boring (SB-1) that were advanced at Landfill 2 encountered the regional upper most saturated zone at approximately 955 ft. amsl (Burgess & Niple, 1996a). The drilling logs indicate no groundwater bearing zones, sand seams or perched zones in any of these borings above the regional upper most saturated zone. The surface of the adjacent Crosses Run lies at an elevation of approximately 967 and may have a maximum depth of 2 feet. This indicates the southeast flowing groundwater in the regional upper most saturated zone is separated by at least 10 feet of confining silty clay till. However, the landfill delineation study indicated that along the western edge of the landfill a saturated condition in the waste existed. It is proposed that three (3) DPTs be advanced within the limits of the landfill, along it's length-wise axis (Figure 4.2), to help characterize the existing conditions. These DPTs will be used to determine the depth of the waste/native soil interface; determine the saturated conditions of the waste; collect a groundwater sample from the saturated waste (if existing); collect TCLP samples from the waste; and collect geotechnical samples (shelby-tubes) from both the wastes and the underlying native till. Only one (1) groundwater sample, one (1) TCLP sample from the landfilled material and one geotechnical sample from each medium (landfill material and nature soil) will be collected at Landfill 2. The TCLP and groundwater sample will be composited from the three DPTs advanced at Landfill 3. A more detailed description of the landfill DPTs is presented in Section 4.2.2.4, "In-Landfill DPT".

It was noted in the boring logs from MW-22, MW-23, and SB-1, located between 50 ft. and 20 ft. from Crosses Run, that the total depth of the waste was 2.6 ft., 2.0 ft., and 8.0 ft., respectively. Except for SB-1, the depth of waste nearer Crosses Run is shallower than the depths encountered in the delineation borings. This would be expected as typical landfill operation would have tapered the depth of fill the closer it was to the stream. However, because the proximity of SB-1 to Crosses Run and the depth of fill at this location is 8.0 ft., it is proposed to advance five (5) hand-augers between MW-22, MW-23, and SB-1 and the stream to further delineate the limits of fill (Figure 4.2).

Because it was noted during the previous DPT investigation to determine the limits of Landfill 2 (Burgess & Niple, 1998) that wet or saturated conditions may exist within the fill of Landfill 2, water may be migrating directly through the stream embankment from the landfill. To evaluate the potential for migration, it is proposed to carefully and methodically examine the embankment separating Landfill 2 from Crosses Run. So as to have an unobstructed view, the embankment vegetation from the water line to a distance of 15 feet back will be removed by mechanical means along the length of the landfill (Figure 4.2). The cleared portion of the landfill edge will be closely examined, logged and mapped. As little disruption as possible of the embankment soil will be achieved. Where intrusive work is needed, a hand held shovel and hand augers will be used. Holes made during the investigation will be backfilled, tamped-down, and seeded as soon as possible to assure initial embankment stability.

In-landfill DPTs will be installed according to the procedures in Section 4.2.2.4.

Table 4.1 presents a summary of the sampling plan for this unit. Test pit excavations will be conducted on an as-needed basis to further define the horizontal and lateral extent of material near the unit boundary, as it is known to exist. All test pits will be excavated, logged, and backfilled with the excavated material the same day as excavation. Test pits located next to crosses run creek will be conducted as close to the creek as possible without allowing the creek to flood the excavation (a distance of approximately 3 to 5 ft. from the creek).

4.1.3 Landfill 3

Landfill 3 is located in the northeast portion of the Scotts property, southeast of Scottslawn Road and under State Route 33. A portion of the landfill is located northeast of State Route 33. On the other side of State Route 33 (southwest side) a small portion of the landfill may exist. However, this is inconclusive (Burgess & Niple, 1998). Rodent activity around the northeast portion of the landfill has locally exposed waste (Burgess & Niple, 1998). The landfill was disturbed by the Ohio Department of Transportation (ODOT) when Route 33 was built in the late 1960s. In May 1998 ODOT conducted shallow soil and sediment sampling in the right-of-way along the east and west bound lanes of Route 33 (DSI, 1999). The drainage ditch on the north side of Route 33 cuts through the landfill and has exposed the vermiculite waste material. Based on the vermiculite exposure in the ditch and the results of the soil and sediments sampling ODOT conducted, the limits of known waste are shown on Figure 4.3. A detailed description of Landfill 3 is presented in Section 2.4.3.

The extent of Landfill 3 on the southwest side of State Route 33 (Figure 4.3) is not known. Therefore, two (2) hand auger locations are proposed to be advanced on the southwest side of the highway outside of the right-of-way, on Scott's property. Except for MW-34 and MW-37 boring activity, no samples have been collected from this side of State Route 33 to evaluate Landfill 3 (Burgess & Niple, 1998b). At each hand auger location soil cuttings will be inspected for visual determination of whether or not vermiculite is present. Minimum depth to advance the hand

augers will be 2.5 feet since that is probably the thickest that cover would have been placed on the fill. The deepest the hand augers need to be advanced is 60 inches. The hand-augers will be continuously logged to total depth. If fill material is encountered then an archive sample will be collected in a one-liter container. If evidence of landfill material is noted during the visual inspection of the soil cuttings, then additional hand augers may be added to laterally delineate the extent of Landfill 3. The decision to revise the scope of the hand augering will be reviewed at that time.

The limits of fill on the northeast side of State Route 33 have been delineated based on the ODOT investigation (DSI, 1999) conducted in June 1998 (Burgess & Niple, 1998), previous borings for groundwater monitoring wells, and visual evidence on the surface of Landfill 3. Along the east property line fence, separating the Scott's property with the Eugene W. and Mary A. Mayer property, vermiculite or fill was encountered from the tree line on the north to the south and southeast along the right-of-way fence. As shown on Figure 4.3, six (6) hand auger locations are proposed to be advanced on the northeast side of the highway outside of the right-of-way, on the Eugene W. and Mary A. Mayer property. The same procedure described above, regarding hand augers on the southwest side of the right-of-way, applies to these six (6) hand augers. The property lines will be surveyed after the intrusive work has been completed.

The groundwater flow in the vicinity of Landfill 3 is to the south-by-southeast. All four of the monitoring wells installed in this area (MW-32, MW-33, MW-34, and MW-37) encountered the top of the regional upper most saturated zone at depths that ranged from 950 ft. to 944 ft. amsl. Based on the boring logs, these four (4) monitoring wells were installed outside the limits of fill and shallow saturated zones were not identified in these monitoring wells. However, as shown on Figure 4.3, because of the proximity of Landfill 3 to Crosses Run, both laterally and vertically, two (2) DPTs are proposed to be advanced in the known limits of fill. These DPTs will be used to determine the depth of the waste/native soil interface; determine the saturated conditions of the waste; collect groundwater sample from the saturated waste (if existing); collect TCLP samples from the waste; and collect geotechnical samples (shelby-tubes) from both the wastes and the underlying native till. Only one groundwater sample, one TCLP sample from the landfill 3. The TCLP and groundwater sample will be composited from both DPTs advanced in Landfill 3. A more detailed description of the landfill DPTs is presented in Section 4.2.2.4, "In-Landfill DPTs".

Table 4.1 presents a summary of the sampling plan for this unit. Test pit excavations will be conducted on an as-needed basis to further define the horizontal and lateral extent of material near the unit boundary, as it is known to exist. All test pits will be excavated, logged, and backfilled with the excavated material the same day as excavation.

4.1.4 Landfill 4

Landfill 4 is on the south-by-southeast corner of the Scotts property. Crosses Run flows along the north side of the landfill. An unnamed tributary to Crosses Run flows along the east side of the landfill. Rodent activity around the landfill has locally exposed waste (Burgess &Niple, 1998b). The limit of waste is shown on Figure 4.4.

The groundwater flow direction is to the east, as measured in the monitoring wells that are screened in the regional upper most saturated zone (MW-21, MW-28, MW-30, MW-36), in the vicinity of Landfill 4, Landfill 5, and FBA 1. There have also been three monitoring wells installed (MW-29, MW-31, MW-35) in the vicinity of Landfill 4 that have been screened in the localized shallow saturated zones, and appear not to be hydrologically connected. However, the

localized shallow saturarted zone monitored by one of these wells, MW-31, may be hydrologically connected to Crosses Run.

Two (2) DPT borings are proposed to be advanced north and northwest of Landfill 4 (Figure 4.4). In monitoring wells MW-36 and MW-29 the first encountered saturated seams were found at depths of 30.5 ft. (approximately 952.5 ft. amsl) and 22.4 ft. (963.5 ft. amsl), respectively. The MW-36 screened zone (952.5 to 942.5 ft. amsl) appears to be in the regional upper most saturated zone, whereas, the screened zone in MW-29 appears to have captured one of the localized shallow saturated zones. These two proposed DPT borings will be advanced outside the limits of the landfill to determine the existence of localized shallow saturated seams and/or fracturing of the glacial till in the upper 25 feet. Their proposed locations are designed to intercept any localized shallow saturated zones that may exist between the northwest edge of Landfill 4 and Crosses Run. If shallow saturated seams are encountered in the DPTs then a monitoring well will be advanced in the DPT location that had shown the most significant groundwater.

Fifteen (15) borings were advanced in the area of Landfill 4 during the Burgess and Niple waste delineation activity (Burgess & Niple, 1998b). In one of the borings (B-39), along the north edge of the landfill limits, fill material was found at a depth of 8.0 feet and wet conditions at 6.0 feet. Because of this and the proximity of the landfill to Crosses Run and the south tributary to Crosses Run, one (1) additional DPT is proposed to be advanced within the limits of Landfill 4. This DPT will be used to determine the depth of the waste/native soil interface; determine the saturated conditions of the waste; collect a groundwater sample from the saturated waste (if existing); collect TCLP samples from the waste; and collect geotechnical samples (shelby-tubes) from both the wastes and the underlying native till. The TCLP sample will be composited from those intervals in the DPT that had waste material. The DPTS will be installed according to the procedures specified in Section 4.2.2.4.

The semiannual groundwater monitoring currently being conducted will include the monitoring well(s) proposed at Landfill 4, if they are installed. However, the semiannual groundwater monitoring is not within the scope of this RFI work plan.

Table 4.1 presents a summary of the sampling plan for this unit. Test pit excavations will be conducted on an as-needed basis to further define the horizontal and lateral extent of material near the unit boundary, as it is known to exist. All test pits will be excavated, logged, and backfilled with the excavated material the same day as excavation.

4.1.5 Landfill 5

Landfill 5 is on the south-southeastern portion of the Scotts property. Crosses Run flows along the north side of the landfill. An unnamed tributary stream to Crosses Run flows along the west side of the landfill, between Landfill 5 and Landfill 4. Rodent activity around the landfill has locally exposed waste (B&N 1998b). The limit of waste is shown on Figure 4.4.

The groundwater flow direction is to the east, as measured in the monitoring wells that are screened in the regional upper most saturated zone (MW-21, MW-28, MW-30, MW-36), in the vicinity of Landfill 5, Landfill 4, and FBA 1. As with Landfill 4, there have also been three monitoring wells installed (MW-29, MW-31, MW-35) in this area that have been screened in the localized shallow saturated zones, and appear not to be hydrologically connected. However, the localized shallow saturated zone monitored by one of these wells, MW-31, may be hydrologically connected to Crosses Run.

Currently there is only one downgradient well (MW-35) to monitor Landfill 5 and it is screened in a localized shallow saturated zone. One other groundwater monitoring well will be installed along the east side of Landfill 5, next to the railroad tracks (Figure 4.4). This monitoring well will characterize the possible extent of groundwater contamination in the regional upper most saturated zone. The targeted top of screen elevation for this well is approximately 955 ft. amsl. The placement of the monitoring well will intercept downgradient flow from Landfill 5. During the installation of this well, a careful inspection of the drilling logs will be conducted in order to evaluate the possible existence of localized shallow sand seams and fracturing of the glacial till in the upper 25 feet. If a hydrologically significant shallow saturated zone(s) is encountered while drilling the primary monitoring well, then at that time, nesting of a shallow monitoring well at this location will be evaluated.

Two (2) DPT borings are proposed to be advanced southwest of Landfill 5 (Figure 4.4). In monitoring wells MW-30 and MW-31 the first encountered saturated seams were found at depths of 25 ft. (957.7 ft. amsl) and 20.4 ft. (960.5 ft. amsl), respectively. Monitoring well MW-30 appears to be screened (957.7 to 947.7 ft. amsl) in the regional upper most saturated zone. The screen interval in MW-31 appears to have captured a localized shallow saturated zone that may be hydrologically connected to the adjacent Crosses Run. The proposed DPT borings will be advanced to determine the existence of localized shallow saturated seams and/or fracturing of the glacial till in the upper 25 feet. Their proposed locations are designed to intercept any localized shallow saturated zones that may exist between the southwest edge of Landfill 5 and the unnamed tributary to Crosses Run. If shallow saturated seams are encountered in the DPTs then a monitoring well will be advanced in the DPT location that shows the most significant groundwater.

Sixteen (16) borings were advanced in the area of Landfill 5 during the Burgess and Niple waste delineation activity (Burgess & Niple, 1998b). In one of the borings (B-47) vermiculite was found to a depth of three feet at or just south of the south property line. Therefore, two (2) hand augers are proposed to be advanced just south of the current known limits of the landfill. At each hand auger location soil cuttings will be inspected for visual determination of whether or not vermiculite is present. Minimum depth to advance the hand augers will be 2.5 feet since that is probably the thickest a cover would have been placed on the fill. The deepest the hand augers need to be advanced is to 60 inches. The hand-augers will be continuously logged to total depth. If fill material is encountered then an archive sample will be collected in a one-liter container. If evidence of landfill material is noted during the visual inspection of the soil cuttings then additional hand augers may be added to laterally delineate the extent of Landfill 3. The decision to revise the scope of the hand augering will be reviewed at that time. This property line will be surveyed after the intrusive work has been completed.

The sixteen (16) borings that were advanced in the area of Landfill 5 during the Burgess and Niple waste delineation activity (Burgess & Niple, 1998b) indicated no wet or saturated conditions in the waste. However, due to the proximity of the landfill to Crosses Run and the south tributary, two (2) additional DPTs are proposed to be advanced within the limits of Landfill 5. These DPTs will be used to determine the depth of the waste/native soil interface; determine the saturated conditions of the waste; collect groundwater samples from the saturated waste (if existing); collect TCLP samples from the waste; and collect geotechnical samples (shelby-tubes) from both the wastes and the underlying native till. Only one groundwater sample, one TCLP sample from the landfill material and one geotechnical sample from each medium (landfill material and nature soil) will be collected at Landfill 5 from these two (2) DPTS. The TCLP and groundwater sample will be composited from the two DPTs advanced in Landfill 5. The DPTs will be installed according to the procedures specified in Section 4.2.2.4.

In addition, three (3) DPTs will be collected from the longitudinal axis of Landfill 5 (see figure 4.4) to further define the depth of contamination at this unit. Two analytical samples will be collected from each DPT location at the 1-2 or 2-3 ft depth interval and the 3-4 or 4-5 ft depth interval. The actual depth of each of the two samples from the DPT will be based on field observations. Each of these samples, designated as full suite, will be analyzed for inorganic constituents, SVOCs, herbicides and pesticides.

The semiannual groundwater monitoring currently being conducted will include the monitoring well(s) proposed at Landfill 5, if it is installed. However, the semiannual groundwater monitoring is not within the scope of this RFI work plan.

Table 4.1 presents a summary of the sampling plan for this unit. Test pit excavations will be conducted on an as-needed basis to further define the horizontal and lateral extent of material near the unit boundary, as it is known to exist. All test pits will be excavated, logged, and backfilled with the excavated material the same day as excavation.

4.1.6 Field Broadcast Area 1

FBA 1 is located in the southern portion of the facility (Figure 4.5). FBA 1 was used for the spreading of off-spec fertilizers and other lawn care products. A more detailed description of this unit is presented in Section 2.4.6 of this document.

The groundwater flow direction in the vicinity of FBA 1 is to the east. Currently there is only one downgradient well (MW-28) to monitor FBA 1. One (1) groundwater monitoring well will be installed along the east side of FBA 1, next to the railroad tracks (Figure 4.5). This monitoring well will characterize the possible extent of groundwater contamination in the regional upper most saturated zone. The targeted top of screen elevation for this well is approximately 960 ft. amsl. The placement of the monitoring well is to intercept any east-by-southeast component of downgradient flow that may exist around FBA 1. During the installation of this well, a careful inspection of the drilling logs will be conducted in order to evaluate the possible existence of a localized shallow saturated zone and fracturing of the glacial till in the upper 25 feet. In existing monitoring wells, MW-21 and MW-31, silty sand was found at a depth of 16.6 ft. (971.2 ft. amsl) and 20.4 ft. (960.5 ft. amsl), respectively. If a hydrologically significant shallow saturated zone(s) is encountered while drilling the primary monitoring well, then at that time, nesting of a shallow monitoring well at this location will be evaluated. If no hydrologically significant zone or monitorable horizon is encountered in the upper 35 feet of soil, no monitoring well will be installed in this location.

In September 1998 three (3) soil samples were collected approximately 50 feet southwest of the FBA-1 southwestern boundary, as shown in Figure 4.5. Samples were analyzed for pesticides and herbicides. Chlordane was the only constituent detected. Soil-38 and Soil-40 had detections of Chlordane at 0.13 mg/kg and 0.27 mg/kg, respectively.

Two (2) DPT borings will be advanced at FBA 1, as shown in Figure 4.5. In monitoring wells MW-28 and MW-31 the first encountered saturated seams were found at depths of 43.5 ft. (935.4 ft. amsl) and 20.4 ft. (960.5 ft. amsl), respectively. Monitoring well MW-28 appears to be screened (943.9 to 933.9 ft. amsl) in the regional upper most saturated zone. The screen interval in MW-31 appears to have captured a localized shallow saturated zone that may be hydrologically connected to the adjacent Crosses Run. The DPT locations are designed to intercept any localized shallow saturated zones and/or fracturing of the glacial till in the upper 25 feet that may

exist between the southeast edge of FBA 1 and Crosses Run. If shallow saturated zones are encountered in the DPTs, then a monitoring well will be advanced in the DPT location that had shown the most significant groundwater.

The semiannual groundwater monitoring currently being conducted will include the monitoring well(s) proposed at FBA 1, if they are installed. However, the semiannual groundwater monitoring is not within the scope of this RFI work plan.

Eight (8) surface soil samples (surface to 1 ft.) will be collected from FBA 1, as shown in Figure 4.5. The initial sampling conducted on FBA 1 consisted of six (6) samples that tended to be grouped near the center of the unit. Therefore, four (4) samples will be taken near the four (4) corners of the rectangle delineated by the railroad tracks, Crosses Run, Scottslawn Road, and the access road on the west side of FBA 1 to better define the extent of contamination on the surface of the unit. These four (4) samples, designated as full suite, will be analyzed for inorganic constituents, SVOCs, herbicides, and pesticides. The samples collected to date from this unit were not analyzed for inorganic constituents. Therefore, eight (8) samples (to provide a statistically significant population size for risk analysis) will be collected and analyzed for inorganic constituents, the four (4) from the corners of the unit and four (4) additional samples. These four (4) samples will be collected in the vicinity of the six (6) previous samples. These four (4) samples will be analyzed for inorganic constituents only.

Table 4.1 presents a summary of the sampling plan for this unit. Test pit excavations will be conducted on an as-needed basis to further define the horizontal and lateral extent of material and conditions at the unit. All test pits will be excavated, logged, and backfilled with the excavated material the same day as excavation.

4.1.7 Field Broadcast Area 2 (Including Former Ponds 7 and 8)

FBA 2 is located in the northwestern portion of the facility, as shown in Figure 4.6. Former Ponds 7 and 8 are located in the southern portion of FBA 2. Former Pond 7 is directly north of former Pond 8. FBA 2 was used for the spreading of off-spec fertilizers and other lawn care products. Former Ponds 7 and 8 were probably part of the pond system utilized in process recycle streams. More detailed descriptions of these units are presented in Section 2.4.7 of this document.

One (1) groundwater monitoring well is proposed to be installed in FBA 2. There is currently no upgradient monitoring well in FBA 2. This well will be placed in the north corner of the area and will serve as the upgradient monitoring well (Figure 4.6).

Three (3) DPT borings are proposed to be advanced along the perimeter of FBA 2, as shown in Figure 4.6. In existing monitoring wells MW-27 and MW-40, saturated zones were found at a depth of 27.0 ft. (958.5 ft. amsl) and 7.0 ft. (approximately 977 ft. amsl), respectively. Monitoring well MW-27 appears to be screened (958.5 to 948.5 ft. amsl) in the upper most saturated zone, whereas, the screen interval in MW-40 appears to capture one of the localized shallow saturated zones. The proposed perimeter DPT borings will be advanced to determine the existence of localized shallow saturated zones and/or fracturing of the glacial till in the upper 25 feet. Their proposed locations are designed to be spaced as evenly as possible from MW-27, the downgradient corners (south end) and the proposed upgradient monitoring well at the north corner of FBA 2. If shallow saturated zones are encountered in the DPTs, then a monitoring well will be advanced in the DPT location that shows the most significant groundwater.

Two (2) additional DPTS are proposed to be advanced within the limits of FBA 2 and within the two (2) former ponds. These DPTs will be placed in the middle of former Ponds 7 and 8. These DPTs will be used to collect a surface soil sample (full suite); determine the depth of the sediment/native soil interface; determine the saturated conditions of the waste; collect groundwater samples from the saturated waste (if existing); and collect geotechnical samples (shelby-tubes) from both the wastes and the underlying native till. In addition to the surface soil analytical samples collected from these two (2) DPTs, additional full suite analytical samples will be collected in five foot intervals (4 ft. to 6 ft, 9 ft. to 11 ft., And 14 ft. to 16 ft.). Total depth will be either 15 feet bgs or native till after observing sediment/waste material.

The semiannual groundwater monitoring currently being conducted will include the monitoring well(s) proposed at FBA 2, if they are installed. However, the semiannual groundwater monitoring is not within the scope of this RFI work plan.

A total of eight (8) surface soil samples (surface to 1 ft.) will be collected on FBA 2, as shown in Figure 4.6. Two (2) surface soil samples will be collected from the 2 DPT locations, as previously described. Three (3) other surface soil samples will be placed near the edges of the triangle delineated by the railroad tracks, North Branch of Crosses Run, and the tree line on the west side of FBA 2 to further define the extent of surface contamination at the unit. The soil sample location in the southeast corner of the triangle will be hand-augered down to five feet to determine if there is any landfill material visible. If there is any landfill material at a depth greater than 0.5 feet then an additional sample will be collected from that depth. These five samples will be analyzed for the full suite of chemical parameters: inorganic constituents, SVOCs, herbicides, and pesticides. As with FBA 1, previous surface soil samples will be collected in the vicinity of the five (5) previously sampled soil locations that will be analyzed for inorganic constituents.

Table 4.1 presents a summary of the sampling plan for this unit. Test pit excavations will be conducted on an as-needed basis to further define the horizontal and lateral extent of material and conditions at the unit. All test pits will be excavated, logged, and backfilled with the excavated material the same day as excavation.

4.1.8 Former Pond 2

Former Pond 2 is located in the northwestern corner of the Scotts property, northwest of Pond 1. After operations ceased, former Ponds 2 was backfilled and planted with grass to match the surrounding area. A detailed description of this unit is presented in Section 2.4.8.

Additional soil samples will be collected to complement the previously collected soil samples at Pond 2. From the previous study activity (Burgess & Niple, 1998b) done in August 1998, six (6) surface soil samples were collected from the DPT locations. To complete the statistical requirements of the risk analysis, an additional two (2) DPTs will be advanced within the pond structure to the backfill/natural till interface (Figure 4.7). From each DPT, continuous samples from the surface to total depth will be collected for lithologic description. The surface interval sample (surface to 1 ft.) will be collected from the DPTs for full suite analysis: inorganic constituents, SVOCs, herbicides, and pesticides. These DPTs will be used determine the depth of the sediment/native soil interface; determine the saturated conditions of the sediment; collect groundwater samples from the saturated sediment (if existing); collect TCLP samples from the underlying native till. In addition to the surface soil analytical samples collected from these two (2) DPTs, additional full suite analytical samples will be collected in five foot intervals (4 ft. to 6 ft, 9 ft. to 11 ft., and 14 ft. to 16 ft.). Total depth will be either 15 feet bgs or native till after observing sediment/waste material.

One (1) sub-surface sample will be collected from each DPT for additional analysis for Total Organic Carbon (TOC) will be conducted. The TOC results will be used to calculate site specific soil screening levels that will be used in the risk analysis. This information will also be useful in evaluating remedial alternatives.

One (1) additional DPT boring will be advanced to the south of the Pond 2 limits (Figure 4.7). In existing monitoring wells MW-38 and MW-39, saturated seams were found at depths of 17.0 ft. (approximately 969 ft. amsl) and 30.5 ft. (approximately 956 ft. amsl), respectively. Monitoring well MW-39 (961 to 951 ft. amsl) appears to be screened in the regional upper most saturated zone. The screened zone in MW-38 appears to capture one of the localized shallow saturated zones. The DPT boring will be advanced to determine the possible existence of shallow saturated seams and/or fracturing of the glacial till in the upper 25 feet. The proposed location is downgradient to Pond 2 along the south side of the pond and approximately 300 feet west of MW-39. If shallow saturated seams are encountered in the DPT, then a monitoring well will be advanced at that location.

In addition, the ditch that formerly connected Pond 1 and Pond 2 (hereafter "Pond 2 ditch") will be investigated using a combination of DPTs and excavation of test pits. It is anticipated that two test pits and three (3) DPTs will be advanced in the ditch that formerly connected Pond 1 and Pond 2 (see Figure 4.7) to further define the contamination at the Pond 2 ditch. The test pits will be placed near the entrances to former Pond 1 and 2 to determine the exact location of the Pond 2 ditch and to guide the installation of the DPT samples. The test pit at the entrance to Pond 1 will be placed at a sufficient distance from the Pond 1 cap so as not to disturb the cap. Analytical samples will be collected from each test pit and DPT location at the depth interval that exhibits the highest concentration of contamination based on field visual observation. Each of these samples, designated as full suite, will be analyzed for inorganic constituents, SVOCs, herbicides and pesticides. All test pits will be excavated, logged, and backfilled with the excavated material the same day as excavation.

The semiannual groundwater monitoring currently being conducted will include the monitoring well(s) proposed at Pond 2, if they are installed. However, the semiannual groundwater monitoring is not within the scope of this RFI work plan.

4.1.9 Former Pond 3

Former Pond 3 is located in the northwestern corner of the Scott's property, north of former Pond 2 and south of the north branch of Crosses Run creek and FBA 2. After operations ceased, former Pond 3 was backfilled and planted with grass to match the surrounding area. A detailed description of this unit is presented in Section 2.4.8.

Within the limits of former Pond 3, six (6) sample locations are proposed, as shown on Figure 4.7. Four (4) of these sample locations are for collecting only surface soil samples (surface to 1 ft.) And will be analyzed for the full suite of constituents: inorganic constituents, SVOCs, herbicides, and pesticides. Two (2) DPTs will be advanced within the pond structure to the backfill/natural till interface (Figure 4.7). From each DPT, continuous samples from the surface to total depth will be collected for lithologic description. The surface interval sample (surface to 1 ft.) will be collected from the DPTs for full suite analysis. These DPTs will be used determine

the depth of the sediment/native soil interface; determine the saturated conditions of the sediment; collect a groundwater sample from the saturated sediment (if existing); collect a TCLP sample from the sediment; and collect geotechnical samples (shelby-tubes) from both the sediment and the underlying native till. In addition to the surface soil analytical samples collected from these two DPTs, additional full suite analytical samples will be collected from both DPTs in five foot intervals (4 ft. to 6 ft, 9 ft. to 11 ft., and 14 ft. to 16 ft.). Total depth will be either 15 feet bgs or native till after observing sediment/waste material.

One (1) DPT boring is proposed to be advanced between former Pond 3 and north branch of Crosses Run, as shown in Figure 4.7. The proposed DPT boring will be advanced to determine the existence of localized shallow saturated zones and/or fracturing of the glacial till in the upper 25 feet. If shallow saturated zones are encountered in the DPT, then a monitoring well will be advanced in the DPT location that shows the most significant groundwater.

4.1.10 Former Pond 6

Former Pond 6 is located in the northwestern corner of the Scott's property, southwest of Pond 1 and north of Ponds 4 and 4A. After operations ceased, former Pond 6 was backfilled and planted with grass to match the surrounding area. A detailed description of this unit is presented in Section 2.4.8.

Within the limits of former Pond 6, five (5) sample locations are proposed, as shown on Figure 4.7. Four (4) of these sample locations are for collecting only surface soil samples (surface to 1 ft.) and will be analyzed for the full suite of constituents. A DPT will be advanced within the pond structure to the backfill/natural till interface (Figure 4.7). This DPT will be used determine the depth of the sediment/native soil interface; determine the saturated conditions of the sediment; collect a groundwater sample from the saturated sediment (if existing); collect a TCLP sample from the sediment; and collect geotechnical samples (shelby-tubes) from both the sediment and the underlying native till. In addition to the surface soil analytical samples collected from this DPT, additional full suite analytical samples will be collected in five foot intervals (4 ft. to 6 ft, 9 ft. to 11 ft., and 14 ft. to 16 ft.). Total depth will be either 15 feet bgs or native till after observing sediment/waste material.

In the event that contamination above background and/or above levels that present an unacceptable risk to human or ecological receptors (based on results of the risk assessment described in Section 8), a groundwater monitoring well system will be placed in an area determined to be down gradient of former Pond 6. Well locations will be coordinated with Ohio EPA.

4.1.11 Crosses Run

Drainage from the facility flows along the north and south branches of Crosses Run that join near the intersection of Scottslawn Road and Industrial Parkway (Plate 1). The Main branch of Crosses Run flows northeast through the Scotts Park, under State Route 33 and north of Landfill 3 toward Mill Creek. A detailed description of Crosses Run as it applies to the Scott's property is presented in Section 2.4.9.

Twenty-two (22) surface water and sediment samples locations in Crosses Run and the tributaries upstream of the north/south branch confluence are proposed as part of the RFI. Plate 6 illustrates the surface water and sediment sample locations. At the time of the surface water and sediment sampling effort the stream flow will be measured at each of the sampling locations. Twelve (12)

of the surface water and sediment sample locations will be collected in the tributaries off site and/or upstream from on-site activities and will serve as background collection data points. These upstream samples will be located far enough upstream from the Scott's property so that the locations will not have been influenced by Scott's waste management activities via fluvial means. From each of the twelve (12) background locations, a surface water sample (if possible) and one (1) surface sediment sample will be collected. The sediments will be collected from the sediment surface to a depth of 2 inches or the top of till, whichever is encountered first.

The remaining ten (10) surface water and sediment sample locations will be placed in areas of Crosses Run that have previously shown nearby elevated levels of analyzed constituents. Two (2) of the ten (10) sample locations will be placed within riffle environments to qualify concentrations in these areas. Eight (8) of the ten (10) sample locations will be in pool habitats. These sediment samples will be collected from two distinct depth zones: from the surface of sediment to 2 inches deep, and from 6 inches to 24 inches deep. If till is encountered before reaching total depth, then the sampling intervals will be adjusted accordingly in order not to sample the till as sediment. Analysis for both surface water and sediment samples collected from the streams will include inorganic constituents, SVOCs, herbicides, and pesticides. Plate 6 illustrates the previous sampling results for Crosses Run and the proposed sample locations. In addition to the above described sampling, two (2) TCLP samples will be collected from the two (2) locations that have previously exhibited the highest concentrations of the constituents of concern.

Four (4) surface water and sediment samples will be collected in Mill Creek. These samples will be collected from the surface of the sediment to 2 inches deep. One sample will be collected upstream of the Crosses Run and three from downstream of the confluence. These samples will be analyzed for inorganic constituents, SVOCs, herbicides, and pesticides.

4.1.12 Background Sample Locations

Background Soil Samples

The background soil samples will be collected in areas of the Scotts Co. property which is unlikely to have received contaminants. Background samples are intended to be representative of conditions that exist in the site vicinity (EPA, 1995). The background samples will be collected in similar geologic strata to the other sample locations and at similar depth. The other locations (previously collected) that the background samples are to represent were collected from depths ranging from the ground surface to a depth of 30 inches. However thirteen out of the fourteen samples were collected from intervals no deeper than 24 inches and the sample that was collected at the 30 inch depth was all non-detects (Burgess & Niple, 1998a). For that reason the depth intervals of the background soil samples will be from the surface to 24 inches.

Twelve (12) surface soil samples will be collected on the Scott's Company property at locations where company activities have not impacted the soils. Analysis for the surface soil samples collected for soils background include inorganic constituents, SVOCs, VOCs, herbicides, pesticides and nitrate/nitrites. Figure 4.8 shows the background soil sampling locations. The background soil analytical results will be used to develop baseline values for the risk assessment.

Background soil samples will be preserved, packaged and sealed in the same manner as the other samples in the same matrix. A separate sample number and station number will be assigned to each background sample, and it will be submitted blind to the laboratory.

Background Groundwater Sample Locations

The background groundwater samples will be collected from monitoring wells that are upgradient to and not influenced by facility operations. The background groundwater monitoring wells will be screened in the regional upper most saturated zone, which represents the water bearing zone that is most prevalent and, therefore, possesses the potential for the most impact.

Three (3) background groundwater monitoring wells will be installed on the Scott's property, as shown on Figure 4.8. The upgradient groundwater monitoring well located north of FBA 2 will serve as a background well. Another well is located just to the east of the west property line on the south side of industrial parkway. The third is located in the northwest corner of the property, north of State Route 33.

4.2 SAMPLE COLLECTION PROCEDURES

The following sections discuss specific methodologies and procedures to be followed during this RFI.

4.2.1 General Procedures

Procedures to be adhered to during all of the field activities are the following procedures taken from the "SAIC Quality Assurance Technical Procedures Volume II: Field Standard Operating Procedures":

- "Chain of Custody" (FTP-625)
- "Packaging and Shipping of Environmental Field Samples" (FTP-650)
- "Field Quality Control" (FTP-1200)
- "Documenting and Controlling Field Changes to Approved Work Plans" (FTP-1220)
- "Use of Field Logbooks (Draft)" (FTP-1215)

These field technical procedures are included in Appendix 4A.

4.2.2 Specific Sampling Procedures

4.2.2.1 Surface Soil Samples

Forty-seven (47) surface soil samples will be collected from seven (7) IUs (FBA 1, FBA 2 and Pond 2, Pond 3, Pond 6, Pond 7, and Pond 8) and locations on the Scott's Company property determined to be suitable for background samples. There locations are shown on Figures 4.5, 4.6, 4.7, and 4.8. Thirty-nine (39) surface soil samples will be analyzed for the full suite of constituents: SVOCs, herbicides, pesticides, and inorganic constituents. Eight (8) surface soil samples will be analyzed for inorganic constituents only (Table 4.1). Surface soil samples will be collected from the ground surface to a depth of 12 inches.

The samplers will use two methods to collect surface soil samples. Depending upon the consistency of the surface soils the samplers may use a stainless steel hand auger or a stainless steel scoop to extract the soils. The field procedures samplers will adhere to are taken from the "SAIC Quality Assurance Technical Procedures Volume II: Field Standard Operating Procedures". The surface soil sampling procedures are the following:

- "Soil Sampling Using an Auger" (FTP-525)
- "Soil Sampling Using a Spade or a Scoop" (FTP-550).

These field technical procedures are included in Appendix 4A. After the samples have been collected, they will be placed in appropriate containers and packed with ice in coolers as soon as practical.

4.2.2.2 Hand Auger Samples

There are fifteen (15) hand auger sample locations proposed on the Scott's Company property. They will be collected on three (3) IUS (Landfill 2, Landfill 3, and Landfill 5) and their locations are shown on Figures 4.2, 4.3, and 4.4. These hand augers will be advanced for the purpose of visually examining the soil for evidence of waste vermiculite.

The samplers will use a stainless steel hand auger to extract the soils. Field procedures will adhere to the "SAIC Quality Assurance Technical Procedures Volume II: Field Standard Operating Procedures". The hand auger soil sampling procedure is the following:

• "Soil Sampling Using an Auger" (FTP-525)

This field technical procedure is included in Appendix 4A.

4.2.2.3 Surface Water and Sediment Samples

As discussed in Section 4.1.9 there are twenty-two (22) surface water and sediment sample locations in Crosses Run (Plate 6). At the time of the surface water and sediment sampling effort the stream flow will be measured at each of the sampling locations. Twelve (12) sampling locations are for collecting background samples and are situated well upstream from IUs. From each of the twelve (12) background locations one (1) surface water sample and one (1) surface sediment sample will be collected. The surface sediment sample depth interval is from sediment surface to 2 inches deep. Ten (10) locations are situated down stream from IUs and in areas that have not been sampled and require further definition to determine the nature and extent of contamination. From each of the ten (10) down stream locations one (1) surface water sample and two (2) sediment samples will be collected. The two (2) sediment samples will be collected from the following depth intervals: from sediment surface to 2 inches deep. All surface water and sediment samples will be analyzed for SVOCs, herbicides, pesticides, and inorganic constituents.

The stream flow will be measured at each of the surface water and sediment sampling locations at the time they are sampled. The stream flow will be measured and calculated with a flow meter and in accordance with the flow meter's instructions.

When collecting surface water and sediment samples the sampler(s) will stand down stream from the sample collection point. Surface water samples will be collected by submerging the sample container at least six inches below the water surface, if possible, and then removing the cap or top to allow the sample container to be filled with water.

The surface sediment samples will be collected using stainless steel equipment, such as a spoon, bucket, scoop, or trowel. Surface sediment samples will be collected from the surface of the natural sediments to a depth of 2 inches. The location, color, and sediment/soil type will be recorded.

At the sampling locations where two sediment samples are to be collected the following sampling procedure will be conducted to assure discrete samples. For the surface to 2 inch depth sampling interval, the top 2 inches of sediment will be carefully removed to minimize sediment disturbance. This sediment will be placed in a stainless steel bowl until sufficient volume is collected to fill a laboratory sample jar. For the sample collected from the 6 to 24 inch depth interval, a hollow three inch PVC schedule 40 casing will be pushed or hammered into the sediment/soil material to an appropriate depth (6 inches or refusal) in order to seal the stream water out of the PVC casing. The water within the PVC will be removed using a conventional disposable bailer. Prior to obtaining the sample, the sediment from the top 6 inches of the sampler will be removed. The sediment sample from the 6 to 24 inch depth interval will be collected within the PVC casing by using a stainless steel bucket auger or a sampler, depending upon the viscosity of the material. After the samples have been collected, they will be placed in appropriate containers and packed with ice in coolers as soon as practical.

4.2.2.4 In-Landfill/In-Pond DPTs

In-Landfill DPTs

In-landfill DPTs will be collected as described herein. First, run a continuous sampler down two (2) feet deep. If waste material has been reached, macro core to that depth and then push a shelby tube in the waste material. If waste has not been found at that depth, continue at 2 feet increments until a shelby tube can be pushed into the waste. If the waste is discovered to be saturated any time while advancing the DPT, stop the advancement to collect a water sample from the hole. After the waste shelby tube has been taken, continue logging the hole continuously until the waste interface with the native soil is achieved. Collect for TCLP analysis the deepest zone of waste found. At that point macro core the hole to depth (into the top of the native material) and push shelby tube into the native material.

As soon as sufficiently full shelby tubes (three-quarters full to full) are collected from both the waste and native material zones in the landfill, then successive attempts for shelby tubes at that landfill are not necessary. For example, if on Landfill 2, the first of the three (3) proposed DPTs collect full shelby tubes of waste and native material, then the other two (2) DPT locations on Landfill 2 will be advanced for only lithologic description, TCLP sample collection and water sample collection

In-Pond DPTs

Based on the boring logs collected from the six (6) boring locations in former Pond 2 it appears that the sediment has been removed from these three ponds and backfilled with native silty clay (till). However, due to the lack of historic information regarding the closures of this pond a prescribed sequence of sampling events will be followed:

1. Two (2) DPTs (per former pond, except former Pond 6, 7 & 8) should be advanced, by running continuous core tubes for lithologic description, to total depth (15 feet) to determine if any waste/sediment material is encountered. [The existing six (6) borings in former Pond 2 were advanced a maximum depth of 10 feet and found only native silty clay.] If no waste/sediment is encountered, ream out the hole (macro core) to depth, then push a shelby tube from 15 ft. To 17 ft. (for geotechnical analysis of the native material). If a sufficient amount of material is collected for the shelby tubes in the first DPT then the consecutive dpts

need only be advanced for lithologic description and analytical sample collection then collect the remaining surface soil samples for that pond.

2. If a DPT encounters waste/sediment material (by running continuous core tubes for lithologic description) then the waste/sediment sample shall be collected for TCLP analysis. Continue until the depth of the waste/sediment interface with the native material is determined and the hole has been logged. If the waste/sediment is saturated, collect a water sample. Then next to that hole (within 5 feet to the side) advance the DPT using a macro core to the depths so shelby tubes may be pushed for both the waste/sediment and native material.

4.2.2.5 Direct Push Technology Borings

DPTs will be used to investigate shallow subsurface materials and collect soil samples. DPTs will be advanced in all the IUs, excluding crosses run. Specifically these DPTs will be used determine the depth of the sediment/native soil interface; determine the saturated conditions of the sediment; collect groundwater samples from the saturated sediment/waste (if existing); collect TCLP samples from the sediment/waste; and collect geotechnical samples (shelby-tubes) from both the sediment/waste and the underlying native till. For this project twenty-eight (28) DPTs are anticipated. Table 4.1 indicates the number and locations of the DPTs.

DPTs will be collected in accordance with the American Society for Testing and Materials (ASTM) D6001-96e1 Standard Guide for Direct Push Water Sampling for Geoenvironmental Investigations and the ASTM D6282-98 Standard Guide for Direct Push Soil Sampling for Environmental Site Characterizations. These field procedures are included in Appendix 4A.

A DPT sampling unit mounted on a carrier vehicle will be used to collect continuous soil samples for classification. Soil samples will be obtained using one inch outside diameter (OD) steel rods attached to a large bore soil core sampler (2 feet long and 1 inch diameter). The samplers will be driven to the desired sampling depth by the static weight of the carrier vehicle and a hydraulic percussion hammer.

Soil samples from each direct push boring will be classified according to the Unified Soil Classification System (USCS) and recorded to provide a continuous log of each boring. In addition to the soil classification the boring logs will include, at a minimum, the soil depth interval, moisture content, and amount of sample recovery.

Former Pond 2, Former Pond 3, Former Pond 6, Former Pond 7, and Former Pond 8 have DPTs proposed to be advanced within the backfill/sediment portion of the pond itself. From these DPTs soil samples will be collected for chemical analysis. The sample will be collected every five feet, over a one foot interval, until the fill/natural till interface is contacted. Prior to collecting each soil sample for chemical analysis, DPT equipment that comes in contact with the soils to be sampled will be decontaminated according to the procedures outlined in Section 4.2.2.7. Samples will be analyzed for SVOCs, herbicides, pesticides, and inorganic constituents. Each boring will be abandoned by plugging with bentonite pellets, and hydrating.

4.2.2.6 Groundwater Monitoring Wells

As many as thirteen (13) monitoring wells are proposed for this RFI. Five (5) of them will be installed and screened in the regional upper most saturated zone. The remaining eight (8) monitoring wells may be installed if the DPTs encounter the localized shallow saturated zone. Table 4.1 indicates the number and location of the monitoring wells.

Groundwater monitoring wells will be installed to confirm geologic and hydrogeologic conditions determined through previous site investigations. The monitoring wells will be used to collect groundwater samples and to determine the hydraulic conductivity of the materials along the screened interval. Groundwater monitoring wells will not be installed at locations where only dense clay till is encountered and there is no monitorable horizon.

Soil borings will be drilled with 4 1/4-inch-diameter hollow stem augers (HSAs). Continuous soil samples of the natural soil materials will be collected during installation of monitoring wells. Samples will be collected with a 2-foot-long, 2-inch-diameter split-spoon samplers. Soil samples will be classified according to a standardized soil classification system and recorded to provide a continuous log of each boring. In addition to the soil classification the boring logs will include, at a minimum, the soil depth interval, moisture content, and amount of sample recovery. Drilling fluids and cuttings will be stored and disposed of according to the methods described in Section 4.5.

Groundwater monitoring wells will be constructed of 2-inch-diameter, Schedule 40 polyvinyl chloride (PVC) riser pipe and screen. General construction details of the groundwater monitoring wells are shown on Figure 4.9. Single-cased wells will be constructed with 5 or 10-foot-long slotted screens with 0.01-inch slot openings. Clean quartz sand filter pack will be placed around the screen in each borehole, and extend approximately two feet above the top of the screen. A 2-foot annular seal of pelletized bentonite will be placed immediately above the sand and hydrated. A cement/bentonite grout will be placed using a tremie pipe in the annular space from the top of the bentonite seal to a depth of three feet bgs. Cement will be placed in the remaining annular space.

Lockable casing protectors approximately five feet long and six inches in diameter will be installed at each monitoring well. The casing protectors will extend approximately 2 1/2 feet above ground surface. The casing protectors will be secured with a concrete pad approximately two feet in diameter. This pad will be sloped to direct surface water away from the well. All monitoring wells will be equipped with locking compression caps and a rust-resistant brass padlock. Protective bumper posts will be installed where appropriate.

4.2.2.6.1 Surveying

All groundwater monitoring wells will be surveyed to provide X, Y, and Z coordinates. Elevation (Z) measurements recorded at each monitoring well will include the ground surface, top of the metal casing protector, and the top of the PVC casing.

4.2.2.6.2 Monitoring Well Development

All new monitoring wells will be developed at least one week prior to sampling. Well development will involve purging water from the wells to remove foreign materials and fines resulting from drilling and well construction activities using a combination of surging and bailing or pumping. Development of the monitoring wells will include procedures that allows the field technician to monitor the stability of the development water. The stability of the development water is monitored by periodic measurements of the following field parameters: turbidity, dissolved oxygen, pH, temperature, and conductivity. Field procedures will adhere to the "SAIC Quality Assurance Technical Procedures Volume II: Field Standard Operating Procedures".

• "Field Measurement Procedure: Turbidity (Draft)" (FTP-910)

- "Field Measurement Procedures: pH, Temperature, Salinity, and Conductivity" (FTP-880)
- "Field Measurement Procedure: Dissolved Oxygen" (FTP-955)

These field technical procedures are included in Appendix 4A. Development water will be collected, stored, and disposed of according to the methods described in Section 4.4.

4.2.2.6.3 Water Level Measurements

Prior to groundwater sampling, depth to water will be measured in groundwater monitoring wells to within 0.01 foot using an electric water level probe. The depths will be subtracted from each respective reference point (top of well casing) resulting in a groundwater elevation relative to the mean sea level. Three measurements will be taken at each well location. The average of the three measurements will be recorded as the groundwater elevation.

4.2.2.7 Groundwater Sampling Procedures

Ten (10) groundwater samples are proposed to be collected from each of the new groundwater monitoring wells. The groundwater samples will be analyzed for SVOCs, herbicides, pesticides, and inorganic constituents.

Field procedures will adhere to the "SAIC Quality Assurance Technical Procedures Volume II: Field Standard Operating Procedures". The groundwater sampling procedures are the following:

- "Groundwater Sampling Procedure: Water level Measurements" (FTP-370);
- "Groundwater Sampling Procedures Using a Bailer" (FTP-600).

Additional procedures to be conducted include collecting field parameters:

- "Field Measurement Procedure: Turbidity (Draft)" (FTP-910);
- "Field Measurement Procedures: pH, Temperature, Salinity, and Conductivity" (FTP-880);
- "Field Measurement Procedure: Dissolved Oxygen" (FTP-955).

These field technical procedures are included in Appendix 4A. After the samples have been collected, they will be placed in appropriate containers and packed with ice in coolers as soon as practical.

4.2.2.8 Decontamination Procedures

Decontamination is a necessary step in the collection of soil, groundwater, surface water and sediment samples. In this investigation samples will be analyzed for trace concentrations of chemicals. Sampling equipment decontamination prevents the potential contamination of samples from the sampling equipment.

The following decontamination procedure will be used for all soil, groundwater, surface water and sediment sampling equipment.

- Wash the equipment thoroughly with phosphate-free laboratory detergent and potable water. Use a brush to remove any particulate matter.
- Rinse the equipment with potable water.
- Rinse the equipment with methanol.

- Rinse the equipment with deionized water.
- Rinse the equipment with 10 percent hydrochloric acid.
- Rinse the equipment with deionized water.

In addition to the above procedures, field procedures the samplers will adhere to are the "SAIC Quality Assurance Technical Procedures Volume II: Field Standard Operating Procedures".

- "Equipment Decontamination" (FTP-400)
- "Cleaning and Decontaminating Sample Containers and Sampling Equipment" (FTP-405)

These field technical procedures are included in Appendix 4A.

4.2.2.9 Slug Testing

All of the groundwater monitoring wells installed as part of this RFI will be slug tested. In general the slug test will provide hydraulic conductivities of the soils adjacent to the monitoring well screens. The field technical procedure the samplers will follow is found in "SAIC Quality Assurance Technical Procedures Volume II: Field Standard Operating Procedures".

• "Aquifer Testing by Slug Test Method" (FTP-376)

These field technical procedures are included in Appendix 4A.

4.3 INVESTIGATIVE DERIVED WASTE

Field waste generated as a result of drilling and sampling activities will be contained on-site until laboratory test results are available for review. Drilling fluids will be contained on-site in drums, frac tanks, or polyethylene tanks. The drill cuttings will be containerized in drums or placed on bermed plastic sheeting and covered. Water resulting from purging and sampling activities will be stored in drums, frac tanks, or polyethylene tanks and labeled. After groundwater analytical results are reviewed, a disposal option will be selected. Disposal methods may include spreading wastes on-site, on-site treatment, discharge into a sanitary sewer, or transport to an approved off-site disposal facility. The disposal method will be based on analytical results.

All test pits will be excavated, logged, and backfilled with the excavated material the same day.

4.4 **REFERENCES**

- Burgess & Niple, Limited (B&N), 1996a. Hydrogeologic Investigation of the Former Disposal Sites November 1996 Groundwater Monitoring Well Installation Results. December 1996
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Dodson-Stilson, Inc. (DSI). 1999. Delineation of Pesticide Occurrence Scottslawn Drive and State Route 33, Marysville, Ohio. February 1999

Environmental Protection Agency (EPA), 1995. Annotated Field Sample Plan. EPA Work Assignment Number: 60-32-9JZZ, Arcswest Program, April 5, 1995

Science Application International Corporation (SAIC), 1996. SAIC Quality Assurance Technical Procedures Volume II: Field SOPs. Revised September 18, 1996

Section 4 Tables)

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Table 4.1 RFI Field Sampling Plan

AOC	Surface Soil Samples (Full Suite)"	Surface Soil Samples (Inorganics Only) ⁶	Subsurface Soil Samples (Full Suite)"	Hand Auger Locations	Test Pit Excavation	Direct Push Tech (DPT) Borings (Continuous Lithologic Sampling)	TOC Samples Collected from DPTs	TCLP Samples Collected From DPT ^b	Geotech. Samples Collected From DP7 ^e	Monitoring Wells (Continuous Lithologic Sampling)	Monitoring Wells (Possible) (Continuous Lithologic Sampling)	Groundwater Sampling (Full Suite) ⁴	Surface Water Sampling (Full Suite) ^a	Sediment Sampling (Full Suite)"	Site Clearing & Inspection	Slug Testing (Possible)
Landfill 1		· · · · · · · · · · · · · · · · · · ·				2					1	1	· · · · · · · · · · · · · · · · · · ·			1
Landfill 2				5	AN	3		1	2			1			1	
Landfill 3				8	AN	2		1	2			1				
Landfill 4					AN	3		_1	2		11	2				1
Landfill 5			6	2	AN	7		1	2	1	2	3				2
FBA 1	4	4			AN	2				1	2	3				3
FBA 2	3	3	1		AN	3				l	1	2				2
Pond 2	7	1	11		AN	6	2	1	2 .		1	2				1
Pond 3	6		6			3		1	2		1	2				1
Pond 6	5		3			1		1	2			I				
Pond 7 (FBA 2)	1		3			1		1	2			1				
Pond 8 (FBA 2)	1		3			1		1	2			1				
Crosses Run								2 ^d					10	18	_	
Background	12									2		2	12 ^e	12e		2
TOTAL	39	8	33	15		34	2	11	18	5	9	22	22	30	1	13

NOTES: Full Suite includes analysis of SVOCs, herbicides, pesticides, and inorganic constituents.

* - The number of samples does not include QA/QC samples, see table 5.1 in Section 5.0 for total number of samples.

^b - One (1) TCLP sample to be collected from each Pond and Uncapped Landfill (from the waste/sediment material).

^c - Two (2) Geotechnical samples to be collected from each Pond and Uncapped Landfill (one from waste/sediment and one from underlying native material).

^d - TCLP Samples of Crosses Run sediment will be collected by hand rather than DPT.

AN = As Needed
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Section 4 Figures



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Appendix 4A

Designation: D 6001 – 96^{€1}

AMERICAN SOCIETY FOR TESTING AND MATERIALS 100 Barr Harbor Dr., West Consnonocken, PA 19428 Reprinted from the Annual Book of ASTM Standards, Copyright ASTM

Standard Guide for Direct-Push Water Sampling for Geoenvironmental Investigations¹

This standard is issued under the fixed designation D 6001; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentness indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

e' Note-Paragraph 1.9 was added editorially October 1998.

1. Scope

1.1 This guide covers a review of methods for sampling ground water at discrete points or in increments by insertion of sampling devices by static force or impact without drilling and removal of cuttings. By directly pushing the sampler, the soil is displaced and helps to form an annular seal above the sampling zone. Direct-push water sampling can be one time, or multiple sampling events. Methods for obtaining water samples for water quality analysis and detection of contaminants are presented.

1.2 Direct-push methods of water sampling are used for ground-water quality studies. Water quality may vary at different depths below the surface depending on geohydrologic conditions. Incremental sampling or sampling at discrete depths is used to determine the distribution of contaminants and to more completely characterize geohydrologic environments. These investigations are frequently required in characterization of hazardous and toxic waste sites.

1.3 Direct-push methods can provide accurate information on the distribution of water quality if provisions are made to ensure that cross-contamination or linkage between water bearing strata are not made. Discrete point sampling with a sealed (protected) screen sampler, combined with on-site analysis of water samples, can provide the most accurate depiction of water quality conditions at the time of sampling. Direct-push water sampling with exposed-screen sampling devices may be useful and are considered as screening tools depending on precautions taken during testing. Exposed screen samplers may require development or purging depending on sampling and quality assurance plans. Results from direct-push investigations can be used to guide placement of permanent ground-water monitoring wells and direct remediation efforts. Multiple sampling events can be performed to depict conditions over time. Use of double tube tooling, where the outer push tube seals the hole, prevents the sampling tools from coming in contact with the formation, except at the sampling point.

1.4 Field test methods described in this guide include installation of temporary well points, and insertion of water samplers using a variety of insertion methods. Insertion methods include: (1) soil probing using combinations of impact, percussion, or vibratory driving with or without additions of smooth static force; (2) smooth static force from the surface using hydraulic penetrometer or drilling equipment, and incremental drilling combined with direct-push water sampling events. Under typical incremental drilling operations, samplers are advanced with assistance of drilling equipment by smooth hydraulic push, or mechanical impacts from hammers or other vibratory equipment. Methods for borehole abandonment by grouting are also addressed.

1.5 Direct-push water sampling is limited to soils that can be penetrated with available equipment. In strong soils damage may result during insertion of the sampler from rod bending or assembly buckling. Penetration may be limited, or damage to samplers or rods can occur in certain ground conditions, some of which are discussed in 4.6. Information in this procedure is limited to sampling of saturated soils in perched or saturated ground-water conditions.

1.6 This guide does not address installation of permanent water sampling systems such as those presented in Practice D 5092.

1.7 Direct-push water sampling for geoenvironmental exploration will often involve safety planning, administration, and documentation.

1.8 This guide does not purport to address all aspects of exploration and site safety. It is the responsibility of the user of this guide to establish appropriate safety and health practices and determine the applicability of regulatory limitations before its use.

1.9 This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many

¹ This guide is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.21 on Ground-Water and Vadose-Zone Investigations

Current edition approved Aug. 10, 1996. Published January 1997.

unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.

2. Referenced Documents

- 2.1 ASTM Standards:
- D 653 Terminology Relating to Soil. Rock. and Contained Fluids²
- D 2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)²
- D 3441 Test Method for Deep, Quasi-Static, Cone and Friction-Cone Penetration Tests of Soil²
- D 4448 Guide for Sampling Groundwater Monitoring Wells²
- D 4750 Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)²
- D 5088 Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites³
- D 5092 Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers³
- D 5229 Practice for Decommissioning Monitoring Wells³
- D 5254 Guide for Minimum Set of Data Elements to Identify a Ground Water Site³
- D 5314 Guide for Soil Gas Sampling in the Vadose Zone³
- D 5434 Guide for Field Logging of Subsurface Explorations of Soil and Rock³
- D 5474 Guide for Selection of Data Elements for Groundwater Investigation³
- D 5521 Guide for Development of Ground Water Monitoring Wells in Granular Aquifers³
- D 5778 Test Method for Performing Electronic Friction Cone and Piezocone Penetration Tests³
- D 5730 Guide to Site Characterization for Environmental Purposes³
- 2.2 Drilling Methods:
- D 5781 Guide for the Use of Dual-Wall Reverse Circulation Drilling for Geoenvironmental Exploration and Installation of Subsurface Water Quality Monitoring Devices³
- D 5782 Guide for the Use of Direct Air-Rotary Drilling for Geoenvironmental Exploration and Installation of Subsurface Water Quality Monitoring Devices³
- D 5783 Guide for the Use of Direct Rotary Drilling with Water-Based Drilling Fluid for Geoenvironmental Exploration and Installation of Subsurface Water Quality Monitoring Devices³
- D 5784 Guide for the Use of Hollow-Stem Augers for Geoenvironmental Exploration and Installation of Subsurface Water Quality Monitoring Devices³
- D 5786 Guide for the Use of Direct Rotary Wireline Casing Advancement Drilling Methods for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices
- D 5785 Guide for the Use of Cable Tool Drilling and Sampling Methods for Geoenvironmental Explorations

and Installation of Subsurface Water Quality Monitoring Devices

- 2.3 Soil Sampling:
- D 1586 Method for Penetration Test and Split-Barrel Sampling of Soils²
- D 1587 Practice for Thin-Walled Tube Sampling of Soils²
- D 3550 Practice for Ring-Lined Barrel Sampling of Soils²
- D 4700 Guide for Soil Sampling in the Vadose Zone²

3. Terminology

3.1 Terminology used within this guide is in accordance with Terminology D 653 with the addition of the following:

3.2 Definitions in accordance with Practice D 5092.

3.3 *bailer*—a hollow tubular receptacle used to facilitate removal of fluid from a well or borehole.

3.4 *borehole*—a circular open or uncased subsurface hole created by drilling.

3.5 casing—pipe, finished in sections with either threaded connections or beveled edges to be field welded, which is installed temporarily or permanently to counteract caving, to advance the borehole, or to isolate the interval being monitored, or combination thereof.

3.6 *caving: sloughing*—the inflow of unconsolidated material into a borehole that occurs when the borehole walls lose their cohesive strength.

3.7 centralizer—a device that helps in the centering of a casing or riser within a borehole or another casing.

3.8 jetting—when applied as a drilling method, water is forced down through the drill rods or riser pipe and out through the end openings. The jetting water then transports the generated cuttings to the ground surface in the annulus of the drill rods or casing and the borehole. The term jetting may also refer to a well development technique.

3.9 *PTFE tape*—joint sealing tape composed of polytetrafluorethylene.

3.10 *well screen*—a filtering device used to retain the primary or natural filter pack: usually a cylindrical pipe with openings of uniform width, orientation, and spacing.

3.11 Definitions of Terms Specific to This Standard:

3.11.1 assembly length—length of sampler body and riser pipes.

3.11.2 *bentonite*—the common name for drilling fluid additives and well construction products consisting mostly of naturally occurring sodium montmorillonite. Some bentonite products have chemical additives that may affect water quality analyses (see 9.3.3).

3.11.3 *direct-push sampling*—sampling devices that are directly inserted into the soil to be sampled without drilling or borehole excavation.

3.11.4 *drill hole*—a cylindrical hole advanced into the subsurface by mechanical means: also, known as borehole or boring.

3.11.5 *effective screen length*—the length of a screen open or exposed to water bearing strata.

3.11.6 *effective seal length*—the length of soil above the well screen that is in intimate contact with the riser pipe and prevents connection of the well screen with ground water from other zones.

3.11.7 grab sampling—the process of collecting a sample of

² Annual Book of ASTM Standards, Vol 04.08.

³ Annual Book of ASTM Standards, Vol 04.09

fluid exposed to atmospheric pressure through the riser pipe with bailers or other methods that may include pumping; also know as batch sampling.

3.11.8 *incremental drilling and sampling*—insertion method where rotary drilling and sampling events are alternated for incremental sampling. Incremental drilling is often needed to penetrate harder or deeper formations.

3.11.9 in situ testing devices—sensors or samplers, used for obtaining mechanical or chemical test data, that are typically pushed, rotated, or driven from the surface or below the bottom of a borehole following completion of an increment of drilling.

3.11.10 *intermittent sampling devices*—usually barrel-type samplers driven or pushed below the bottom of a borehole following completion of an increment of drilling.

3.11.11 percussion driving—insertion method where rapid hammer impacts are performed to insert the sampling device. The percussion is normally accompanied with application of static down force.

3.11.12 *push depth*—the depth below a ground surface datum that the end or tip of the direct-push water sampling device is inserted.

4. Summary of Guide

4.1 Direct-push water sampling consists of pushing a protected well screen to a known depth, opening the well screen over a known interval, and sampling water from the interval. A well point with an exposed screen can also be pushed with understanding of potential cross-contamination effects and purging requirements considered. A sampler with constant outside diameter is inserted directly into the soil by hydraulic jacking or hammering until sufficient riser pipe is seated into the soil to ensure a seal. Protected well screens can be exposed by retraction of riser pipes. While the riser is seated in the soil, water samples can be taken, and water injection or pressure measurements may be performed.

5. Significance and Use

5.1 Direct-push water sampling is an economical method for obtaining discrete ground-water samples without the expense of permanent monitoring well installation (1-4).⁴ This guide can be used to profile potential ground-water contamination with depth by performing repetitive sampling events. Soils to be sampled must be permeable to allow filling of the sample in a relatively short time. The zone to be sampled can be isolated by matching well screen length to obtain discrete samples of thin aquifers. Use of these sampling techniques will result in more detailed site characterization of sites containing multiple aquifers. By inserting a protected sampling screen in direct contact with soil and with watertight risers, initial well development (Guide D 5521) and purging of wells may not be required for the first sampling event. Discrete water sampling, combined with knowledge of location and thickness of target aquifers, may better define conditions in thin multiple aquifers than monitoring wells with screened intervals that can intersect and allow for intercommunication of multiple aquifers (2.4.5.7.8.11). Direct-push sampling performed without knowledge of the location and thickness of target aquifers can result in sampling of the wrong aquifer or penetration through contining beds.

5.2 For sites that allow surface push of the sampling device. discrete water sampling is often performed in conjunction with the cone penetration test (Test Method D 5778) (2–9), which is often used for stratigraphic mapping of aquifers, and to delineate high-permeability zones. In such cases, direct-push water sampling is normally performed close to cone holes. In complex alluvial environments, thin aquifers may vary in continuity such that water sampling devices may not intersect the same layer at equivalent depths as companion cone penetrometer holes.

5.3 Water sampling chambers may be sealed to maintain in situ pressures and to allow for pressure measurements and permeability testing (4,7,10). Sealing of samples under pressure may reduce the possible volatilization of some organic compounds. Field comparisons may be used to evaluate any systematic errors in sampling equipments and methods. Comparison studies may include the need for pressurizing samples, or the use of vacuum to extract fluids more rapidly from low hydraulic conductivity soils (8.1.5.3).

5.4 Degradation of water samples during handling and transport can be reduced if discrete water sampling events with protected screen samplers are combined with real time field analysis of potential contaminants. In limited studies, researchers have found that the combination of discrete protected screen sampling with onsite field analytical testing provide accurate data of aquifer water quality conditions at the time of testing (2,4). Direct-push water sampling with exposed screen sampling devices, which may require development or purging, are considered as screening tools depending on precautions that are taken during testing.

5.5 A well screen may be pushed into undisturbed soils at the base of a drill hole and backfilled to make permanent installed monitoring wells. Procedures to complete direct-push wells as permanent installations are similar to those given in Practice D 5092. These procedures allow for permanent sealing of riser pipe in the borehole. Some state or local regulations may not allow for certain types of direct-push installations as permanent monitoring wells depending on the application. Sometimes, where temporary well screens are inserted at the top of the ground water table, sealing an annulus may not be necessary.

5.6 In difficult driving conditions. penetrating to the required depth to ensure sealing of the sampler well screen may not be possible. If the well screen cannot be inserted into the soil with an adequate seal, the water-sampling event would require sealing in accordance with Practice D 5092 to isolate the required aquifer. Selection of the appropriate equipment and methods to reach required depth at the site of concern should be made in consultation with experienced operators or manufacturers. If there is no information as to the subsurface conditions, initial explorations consisting of penetrationresistance tests, such as Method D 1586, or actual direct-push testing trials can be performed to select the appropriate testing system.

^{*} The boldtace numbers in parentheses refer to a list of references at the end of this guide.

5.6.1 Typical penetration depths for a specific equipment configuration depend on many variables. Some of the variables are the driving system, the diameter of the sampler and riser pipes, and the resistance of the materials.

5.6.2 Certain subsurface conditions may prevent sampler insertion. Penetration is not possible in hard rock and usually not possible in softer rocks such as claystones and shales. Coarse particles such as gravels, cobbles, and boulders may be difficult to penetrate or cause damage to the sampler or riser pipes. Cemented soil zones may be difficult to penetrate depending on the strength and thickness of the layers. If layers are present that prevent direct push from the surface, the rotary or percussion drilling methods (Guides D 5781, D 5782, D 5783, and D 5784, D5785, D5786, and see 2.2) can be employed to advance a boring through impeding layers to reach testing zones.

5.6.3 Driving systems are generally selected based on required testing depths and the materials to be penetrated. For systems using primarily static reaction force to insert the sampler, depth will be limited by the reaction weight of the equipment and penetration resistance of the material. The ability to pull back the rod string is also a consideration. Impact or percussion soil probing has an advantage of reducing the reaction weight required for penetration. Penetration capability in clays may be increased by reducing rod friction by enlarging tips or friction reducers. However, over reaming of the hole may increase the possibility of rod buckling and may allow for communication of differing ground-water tables. Hand-held equipment is generally used on very shallow investigations. typically less than 5-m depth, but depths on the order of 10¹ m have been reached in very soft lacustrine clays. Intermediate size driving systems, such as small truck-mounted hydraulicpowered push and impact drivers, typically work within depth ranges from 5 to 30 m, but can reach depths on the order of 10^2 m. Heavy static-push cone penetrometer vehicles, such as 20-ton trucks, typically work within depth ranges from 15 to 45 m, and also reach depth ranges on the order of 10^2 m in soft ground conditions. Drilling methods (Guides D 5781, D 5782. D 5783, D 5784, D 5785, D 5786, and also see 2.2) using drilling and incremental sampling are frequently used in all depth ranges and can be used to reach depths on the order of 10³ m.

NOTE 1—Users and manufacturers cannot agree on depth ranges for different soil types. Users should consult with experienced producers and manufacturers to determine depth capability for their site conditions.

5.7 Combining multiple-sampling events in a single-sample chamber without decontamination (Practice D 5088) is generally unacceptable. In this application, purging of the chamber should be performed to ensure isolation of the sampling event. Purging should be performed by removing several volumes of fluid until new chemical properties have been stabilized or elements are flushed with fluid of known chemistry. Purging requirements may depend upon the materials used in the sampler and the sampler design.

6. Apparatus

6.1 General—A direct-push sampling system consists of a tip: well screen: chambers, if present: and riser pipes extending

to the surface. Direct-push water sampling equipment can be grouped into two classes, either with a sealed protected screen or exposed screen. Samplers with sealed screens depend on the seal to avoid exposure of the sampling interval to soil or water from other layers. They can be considered as accurate pointsource detectors. They are normally decontaminated between sampling events. Exposed-screen samplers may require purging and development and as such are considered as screening devices for profiling relative degrees of contamination.

6.1.1 Exposed-Screen Samplers—Some direct-push samplers may consist of a simple exposed well screen and riser pipe that allows grab sampling with bailers or pumps. An example of this arrangement is the simple push or well point shown in Fig. 1. (12). The practice of jetting well points is often not acceptable due to the large quantities of water used



FIG. 1 Exposed-Screen Sampler—Well Point Driven Below the Base of a Borehole (12)

for insertion and the resulting potential for disturbance and dilution in the aquifer. If water is used for insertion, knowing the chemical constituents in the water may be necessary. Bias may be possible if an exposed-screen sampler is pushed through multiple contaminated layers. If exposed-screen well points are pushed through predrilled holes the screen and riser may fill with water present in the drill hole and require purging before sampling.

6.1.1.1 Another form of an exposed-screen sampler has been incorporated into cone penetrometer bodies (6). The cone penetrometers have sample chambers with measurement devices such as temperature and conductivity. Some cone penetrometers have been equipped with pumps for drawing in water samples into sample chambers or to the surface. Samplers equipped with chambers and subjected to multiple sampling events may require purging between sampling events. Although several of these designs have been proposed, they have not been successful in production practice. This is because of lengthy and time consuming purging requirements. In most cases, purging requirements and the depths of testing may be such that single-sampling events without cone penetrometers may be more economical than multiple-sampling events requiring purging.

6.1.2 Sealed-Screen Samplers-Protected well screen and simple riser pipes for grab sampling are also deployed. An example is shown in Fig. 2 (13). This simple well screen arrangement allows for grab sampling through the riser pipe without purging or development if there is no leakage at the screen seals and riser pipes. Fig. 3 shows a schematic of a direct-push water sampler with a protected screen and with the ability to work in the grab sampling mode or by allowing water to enter a sample chamber in the sampler body (1). Most simple sample chambers allow for flow through the chamber. When flow through chambered samplers is opened, it is possible that the ground water from the test interval can fill into the rods above the chamber. In those cases, it may be advisable to add water of known chemistry into the rods prior to opening the screen. Some protected-screen samplers have sample chambers designed to reduce volume and pressure changes in the sample to avoid possible volatilization of volatile compounds (4,7,10). The need for pressurization is dependent on the requirements of the investigation program and should be



FIG. 2 Simple Protected Screen Sampler (13)





Legend: Grab Sampling

Legend: Water Sampling in Chamber

A Penetrometer closed while being driven into position.

B Tool opened and 5 foot screen telescopes into position for collec-

- o tool opened and 5 toot screen telescopes into position for co
- tion of hydrocarbon or water sample at the very top of the aquifer. C Hydrocarbon sample being collected using bailer lowered through C
 - ditve casing.

C Check valves closed as sample is retrieved within body of the tool.

A Penetrometer closed while being driven into position.

B Cone separated and tool open to collect sample.

FIG. 3 Protected Screen Sampler Capable of Working in Grab or Chamber Sampling Modes (1)

evaluated by comparison studies in the field with simpler systems allowing the sample to equalize at atmospheric pressure. There are different approaches to pressurizing the sample chamber including use of inert gas pressure or using sealed systems. An example of a sealed vial-septum system is shown in Fig. 4 (4). In the sealed vial system, a septum is punctured with a hypodermic needle connected to a sealed vial. With this approach the vial will contain both a liquid and gas at aquifer pressure. The sealed vial-septum system has been used in an exposed-screen mode.

6.1.3 Materials of Manufacture—The choice of materials used in the construction of direct-push water sampling devices should be based on the knowledge of the geochemical environment to be sampled and how the materials may interact with the sample by means of physical, chemical, or biological processes. Due to the nature of insertion of these devices, the sampler body is typically comprised of steel, stainless steel, or metals of other alloys. The type of metal should be selected based on possible interaction effects with the fluid to be sampled. Well-screen materials can be selected from a variety of materials. Materials commonly used for well-screen elements include steel, stainless steel, rigid polyvinyl chloride (PVC), polytetrafluorethylene (PTFE), polyethylene (PE), polypropylene (PP), and brass. Sample chambers, pumps, and connector lines are also constructed with a variety of materials. Evaluating the possible interaction of materials that will be exposed to the water during the sampling event is important.

6.2 Sampler Body—The sampler body consists of a tip, and a barrel that consists of well screen, a protective sleeve if used, and a sampling chamber if used, with a connector assembly to





FIG. 4 Protected Screen Sampler with Sealed Vial System (4)

attach to riser pipes. The sampler is normally constructed of steel to withstand insertion forces. The sampler barrel should be of constant outside diameter to ensure intimate contact with the soil to be tested. Protective sleeves shall be equipped with O-rings to prevent the ingress of water before the sampling event.

6.2.1 *Expendable Sampler Tips*—Some sampler tips are expendable and are left in the ground after the sampling event. The tip should be equipped with an O-ring seal to the sampler sleeve to prevent leakage into the riser pipe until the sampling depth is reached.

6.2.1.1 Sampler tips are designed so that upon pull back of the sampler body and riser pipe, the tip is disconnected from the sampler. The required diameter, and the ability to expend the tip successfully, depends on the soils to be penetrated. The tip diameter can be set equal to, or slightly less than, the sampler body. If there are problems with tip retraction, tips can be designed with a diameter of 1 to 3 mm ($\frac{1}{16}$ to $\frac{1}{16}$ in.) larger than the sampler body. The use of an enlarged diameter with a larger shoulder or tip may help in reaching greater depths because it acts as a friction reducer. An enlarged tip should not leave too large an annulus above the sampler body and riser pipes as to maintain a seal above the well screen and to prevent potential cross contamination.

6.2.1.2 Most sampler tips are made of steel to withstand pushing forces. With some samplers, after the sampling event, the tip may remain in the ground and the hole may be grouted. The user should consider if leaving the tips below the ground will adversely affect surrounding ground-water chemistry depending on site conditions.

6.2.2 Well Screen—Many materials for well screens are available for direct-push samplers. The material of manufacture should be selected with consideration of chemical composition of the ground water to be sampled and possible interactive effects (see 6.1.3). Some samplers use simple mill slotted steel, or PVC tube. Steel or brass screen formed into a cylinder can be used to cover inlets. Continuous-wrapped, wire-wound well points are also commonly used. The effective opening size of the well screen material should be selected based on the material to be sampled, the time required to sample, and soil sediment that can be tolerated in the water sample. Methods to size well-screen and filter-pack materials are given in Practice D 5092. Clean sands and gravels can be sampled with a screen with larger openings without producing excessive sediment. Clayey and silty soils containing fines may require finer openings. Typical openings of 10 to 60 µm are used. Finer openings will reduce sediment but may also slow ingress of fluid.

6.2.3 Some sampler inlets are not protected by well screen or slotting. The simplest form of sampler can be an open riser pipe with an expendable tip. The use of unprotected inlets has sometimes been useful to sample ground water at soil/bedrock interface. If unprotected inlets are used, one must consider the amount of soil sediment that can be tolerated in the sample.

6.3 Riser Pipes—Also commonly referred to as "push rods" or "extension rods", riser pipes are normally constructed of steel to withstand pushing forces. Some temporary well-point installations may use a double-tube system such as a smalldiameter PVC riser pushed by the steel tube (Fig. 5) (14). Double-tube systems are advantageous if multiple sampling events are required in a single push. Other temporary systems may use a flexible tubing system connected to the well point (Fig. 6) (14). For PVC riser pushed with outside steel tubing, the withdrawal of steel push rods will leave a small annulus between the soil and PVC riser or tubing. This annulus may require grouting depending on the effective seal above the well screen and the possibility of cross contamination of overlying layers. Cone penetrometer rods as specified in Test Method D 5778 are sometimes used in sampling systems deployed with









cone penetrometer equipment. Larger diameter rods, typically 45 mm (1.75 in.), are sometimes used with cone penetrometer equipment. The maximum rod diameter that can be used depends on the material to be penetrated and the driving system. Increased rod diameter causes increase in the required driving force required to penetrate a sufficient distance. Most surface direct-push riser pipes are less than 50 mm (2 in.) in diameter.

6.4 Standard drilling rods used for rotary drilling are normally used when sampling is done at the base of drill holes. Many drill rods are available (see Guides D 5781, D 5782, D 5783, D 5784, D 5785, D 5786, and also see 2.2). For direct-push sampling systems that depend on the riser pipe for grab sampling within the riser, ensuring that joints are watertight will be necessary such that water enters through the well screen interval to be sampled. Rods should be wrenchtightened, and PFTE tape can be used on the threads to stop leakage. The quality checks discussed in Section 8 can be performed to evaluate possible leakage. Sometimes it may be necessary to equip rod joint shoulders with O-rings to prevent leakage. Cone penetrometer rods with precision tapered threads are normally watertight during short sampling events lasting up to 1 h if they are not damaged.

1

6.4.1 Friction Reducers—Friction reducers that have enlarged outside diameters of the riser pipe are sometimes employed to reduce thrust capacity needed to advance the well point or sampler. If friction reducers are used, they must be a sufficient distance above the sampling location to ensure that fluids from overlying layers can enter the sampling zone. If cross-contamination is possible, use of friction reducers should be avoided. In some cases the use of friction reducers can help in forming an annular seal. Donut-type reducers ream the hole smoothly. Lug-type reducers rip and remold the soil and may provide a better annular seal. The type and location of friction reducers should be documented in the project report.

6.4.2 *Mud Injection*—Some direct-push systems inject betonite drill fluid along the drill rods to reduce friction. These systems normally inject the fluid behind friction reducers. These systems may provide better sealing above the sampler for the sampling process but are also more difficult to operate.

6.5 Sampling Devices—Methods to obtain water samples vary widely. Examples are given in 6.1.1 and 6.1.2. Simple grab samplers. most often bailers, are used with simpler systems. Other systems draw water into chambers or sealed vials for retrieval to the surface. Some systems may have pumps and circulation systems to retrieve samples to the surface. The materials of manufacture of samplers, sample containers, pumps, and circulation lines should be selected considering possible interaction effects discussed in 6.1.3. Selection of devices for sampling ground water is presented in Guide D 4448. Sampling methods and devices should be selected in 6.1.3 and other areas in Guide D 4448.

6.6 Sample Containers—Sample containers for sampling ground water are addressed in Guide D 4448.

6.7 Driving or Pushing Equipment-Soil probing (percussion driving) systems, penetrometer systems, and rotary drilling equipment are used for inserting direct-push water sampling devices. The equipment should be capable of applying sufficient mechanical force or have sufficient reaction weight, or both, to advance the sampler or screen to a sufficient depth to ensure an effective seal above the area to be sampled. The advancement system must also have sufficient retraction force to remove the rods, which is often a more difficult task than advancing the rods. Simple advancement systems include hand-held rotary-impact hammers with mechanical-extraction jacks. Many systems use hydraulic- or vibratory-impact hammers operating at high frequency to drive rods into the sampling interval. Reaction force can be reduced if impact hammers are employed. Multipurpose driving systems such as those commonly deployed for soil gas sampling (Guide D 5314) are frequently used in shallow explorations. Some vibratory drilling systems can provide vibration to the rods and easily penetrate cohesionless soils. On soft ground sites, cone penetrometer systems use hydraulic rams to push the sampler and riser pipe into the ground. Conventional rotary drilling rigs can use either hydraulic pull-down capability or hammers to drive the sampler to the required depth. Rotary drilling rigs are often used with the incremental drilling and sampling method. A140-lb SPT hammer (Method D 1586) is available on most rotary drilling rigs and can be used to advance the sampler. Use of impact or vibration may allow for penetration of harder soils. If a significant length of rods whip during driving, they should be restrained to prevent damaging of the annular seal at the base of a borehole from lateral movement.

7. Conditioning

7.1 Decontamination—Sampling equipment that contacts ground water to be sampled before and after the sampling event may require decontamination. Decontamination should be performed following the procedures outlined in Practice D 5088 and the site-sampling plan. The sampler body normally requires complete decontamination before sampling. Wellscreen components are sometimes expendable. Newly manufactured screens and sampler components may contain residues from manufacture and should be cleaned before the sampling event. Riser pipes should be decontaminated if grab sampling will be performed within the tube.

7.2 Purging—For exposed-screen sampling devices and sampling systems open to overlying ground water, purging may be required before the sampling event. With both protected- and exposed-screen samplers, purging may be required if ground water from overlying sources infiltrates into the riser pipes into the sampling area. Purging should consist of removal of overlying ground water from the sampling system prior to the sampling event. Purging requirements are outlined in Guide D 4448.

8. Procedure

8.1 Two procedures are outlined depending on whether the sampling device is pushed directly from the surface or whether drilling is used to advance an open hole close to the sampling interval. In either event, the sampling screen should be advanced into undisturbed soil a sufficient distance to ensure that the sampling depth cannot be exposed to overlying ground water, if present.

8.1.1 Incremental Drilling and Sampling—In this method, advance a drill hole close to the sampling interval using drilling methods listed in 2.2. Of the drilling methods listed, the most commonly employed is rotary hollow-stem auger drilling because fluids are not introduced during the drilling process. If a rotary drilling method using drilling fluid or air is employed, the impact of the fluid or air to the sample quality and quality of the surrounding aquifer should be considered. If caving or sloughing occurs the use of protective casings may be required.

8.1.1.1 Stabilize the drill rig and erect the drill rig mast. Establish and document a datum for measuring hole depth. This datum may consist of a stake driven into a stable ground surface, the top of the surface casing, or the drilling deck. Do not use surface casing as a datum if it is subject to movement. If the hole is to be later surveyed for elevation, record and report the elevation difference between the datum and the ground surface. Proceed with drilling until a depth is reached above the target sampling interval. Check and document the depth of the borehole and condition of the base of the hole. Establish the depth and condition of the base of the boring by resting the sampler at the base of the boring and checking depth to the sampler tip. If casing is used and heave occurs into the casing, remove this material and advance the hole deeper. Heave of soil into the casing may make it impossible to drive the well point without it carrying the casing along with the well point or sampler. If excessive heave, caving, or sloughing of soil occurs. consider using an alternative drilling method capable of maintaining stable soil conditions.

8.1.2 If the sampling event is to occur at the ground-water table and equipment depends on a dry-hole condition, that is, an exposed screen sampler with no purging requirements, test the drill hole to confirm that ground water has not entered the hole. Water levels can be determined using Test Method D 4750.

8.1.3 Attach the well point or sampler to riser pipes and lower into the borehole. Carefully record the assembly length as rod sections are added to the assembly. Centralizers may be used to maintain verticality of the assembly and to reduce rod whip. Rest the assembly on the base of the borehole. Determine and record the depth to the tip of the assembly.

8.1.4 Either push or drive the well point or sampler a sufficient distance below the base of the boring. This distance should be at least 1 m (3 ft), or the minimum to ensure an effective seal. For protected-screen samplers where a protective screen is exposed by pulling back the riser pipe, the withdrawal action may shear or crack soil, allowing connection to the base of the borehole. In these cases, adjust the insertion and retraction lengths according to soil conditions. In general, the sampler should be inserted at least three times the effective screen length from retraction. To check the seal in fluid filled holes, tracers can be introduced into the fluid in the base of the borehole. Document the final depth of insertion to the tip of the sampler and midpoint of the well screen. If the sampler is driven with hammer blows, accomplish the penetration without excessive vibrations that could reduce the effective seal of the riser pipe above the well screen. Normally, if smooth penetration is accomplished with each hammer blow, the seal should be intact.

8.1.4.1 The process of jetting well points is not preferred because of the addition of water, disturbance to the sampling zone, and lack of an effective seal above the screen. These installations are usually intended for permanent installations with the drill hole completed as a monitoring well. If jetting is used, document the approximate volume and chemical quality of water.

8.1.5 Sampling—The sampling process depends on the type of the sampling equipment used, that is, exposed- or protected-screen samplers.

8.1.5.1 Sampling of Exposed-Screen Samplers—Exposedscreen samplers can be sampled after fluids have been purged from the screen and riser pipes. Purge these systems in accordance with Guide D 4448.

8.1.5.2 Sampling of Protected-Screen Samplers—Test protected-screen samplers that are open to the surface through the riser for grab sampling for system leakage before exposing the screen for sampling. Before screen exposure, test the riser for presence of water that may have leaked through joints and connections using Test Method D 4750. If water is present from unknown sources, this should be noted and either purging or abandoning of the test should be considered. After quality checks for leakage, the riser pipes may be pulled or twisted to expose the well screen to the aquifer.

8.1.5.3 Several methods for sampling water are available. If the sampling device uses head pressure available in the aquifer.

sufficient time should be allowed for water to fill the sampling chamber or riser pipes. Some systems allow for connection of a sealed sampling chamber, or tubing, to a port in the sampler body after the screen is opened, allowing direct connections to the screened sampling area. By using these systems, one may avoid the necessity to check inside the riser pipes for leakage water. Use of sampling pumps to draw in the sample may be allowed, but consideration should be given the changes in ambient pressures and temperatures that may change chemical compositions. With an open tube well screen using grab sampling in low permeability soils, a vacuum is sometimes applied to the top of the riser pipe to accelerate ground-water inflow. The use of a vacuum and its effect on chemical composition should be considered and evaluated if site requirements dictate.

8.1.5.4 After a sufficient volume of the sample is obtained, place the samples in suitable containers for analysis. The volume of a sample to obtain depends on the chemical composition of ground water, testing protocols, and the dataquality objectives. Depending on the screen used, samples may contain sediment and may require filtering before placement of samples in containers. Certain testing procedures or regulations may require filtration of water samples.

8.1.6 After sampling, either retrieve the sampler or leave it in place for permanent installation in accordance with Practice D 5092. Some retrievable samplers leave a tip or a well screen element, or both, below the bottom of the boring. If repeated sampling events are to be performed in the same drill hole, drilling it through these pieces if present will be necessary. Depending on the drilling method, a pilot bit should be reinserted in the drill string and drilling continued to a depth exceeding the depth of the previous sampling event. Normally tips or screens, or both, will be moved to the side of the drill hole before the next sampling event. Sometimes the presence of a tip or element, or both, can be detected by drilling action. If drilling action detects these pieces, note the location. Drilling continues to the next depth of concern and sampling may be repeated. The depth of the extended drill hole should equal or exceed the depth to the sampling tip of the previous interval.

8.1.7 After the drilling is completed, the drill hole should be completed following guidelines in drilling methods (Guides D 5781, D 5782, D 5783, D 5784, D 5785, D 5786, and also see 2.2) or those given in Section 9.

8.2 Direct Push from the Surface—Well points and samplers may be advanced directly from the surface with multipurpose percussion driving systems, hand-held rotary percussion drills, cone penetrometer systems, or any other systems capable of supplying sufficient force to reach the depths of concern.

8.2.1 Stabilize and level the rig for testing. For some tire-mounted equipment, the rig can be raised off the ground and leveled with hydraulic rams to lift the rig from the tires to avoid shifting during difficult driving conditions. Establish and document a datum for measuring hole depth. If the hole is to be later surveyed for elevation, record and report the height of the datum to the ground surface.

8.2.2 The sampler body is connected to riser pipes along with any subassemblies such as friction reducers. Prior to driving, measure the length of the sampler assembly and riser pipes to determine the depth of sampling. Some temporary well systems drive a double tube or cased system, where riser pipe and casing are added as it is advanced. This allows for easy annulus grouting as the casing is retracted. The rods are then pushed using smooth quasi static push or impacts, or both. Additional riser pipes are added as pushing progresses. As driving progresses, operators should carefully record the rods added to ensure that sampling occurs at the correct depth.

8.2.3 Sampling of Exposed-Screen Samplers—Use the same procedures in accordance with 8.1.5.1.

8.2.3.1 Sampling of Protected-Screen Samplers—Use the procedure in accordance with 8.1.5.2 with the addition that the riser pipes should be periodically checked for leakage using Test Method D 4750.

8.2.4 After sufficient volume of a sample is procured, place the samples in suitable containers for analysis. The volume of the sample to obtain depends on the chemical composition of ground water, testing protocols, and the data-quality objectives. Depending on the screen used, samples may contain sediment and may require filtering before placement of samples in containers.

8.3 After sampling, the sampler is either retrieved or left in place for permanent installation (Section 9). Some retrievable samplers leave a tip or a well-screen element, or both, at the bottom of the sounding. If repeated sampling events are to be done in the same hole, they must be done with samplers pushed to greater depths.

8.4 After the testing is finished, complete the borehole following the guidelines in Section 9.

9. Completion and Abandonment

9.1 Permanent or Temporary Well Installations—Wells inserted by either drilling methods or direct push from the surface may be left in the ground as permanent or temporary installations. Some state or local regulations may not allow for certain types of direct-push installations as permanent monitoring wells depending on the application. If there are questions as to the performance of direct-push wells, they can be compared to wells installed using rotary drilling methods (Guides D 5781. D 5782, D 5783, and D 5784. D5785. D5786, and also see 2.2) in accordance with Practice D 5092. For wells inserted in drill holes, the drill hole will require completion with sealing materials to ensure a seal between the hole wall and riser pipes. Sealing procedures are given Practice D 5092.

9.1.1 For wells installed by direct push from the surface, the need for sealing depends on the size of the annulus, ground-water quality, and the ability for cross-contaminating or accelerating contamination movements among aquiferts). Temporary well points installed into the top of the first ground-water layer may only require surface sealing. If the annulus is very small, soil cave and squeeze may reduce effective vertical hydraulic conductivity. If the well riser intersects perched aquifers, cross-communication of aquifers may be possible if too large an annulus is left open. Communication can be evaluated by performing tracer tests, if necessary. Friction reducers used on cone penetrometer equipments may only increase hole diameters by 6 to 13 mm ($\frac{1}{4}$ to $\frac{1}{2}$ in.) of that of the steel pipes for pushing.

9.2 Other Completion Methods-Depending on the require-

ments of the investigation, performing special completions with protective casings or other sealing may be necessary. For holes using rotary drilling methods and incremental sampling, the hole could be completed as a monitoring well (Practice D 5092) or with grouted casings for other testing such as geophysical tests. Several methods are available for grouting of casings. Using injection grouting where injection is done at the base of the boring is most desirable and grouts are pumped up the annulus until they reach the surface showing a continuous seal.

9.3 Hole Abandonment—For test holes where there are no installations or other completion methods, the hole should be abandoned following program requirements. The need for and the method of sealing for abandonment depends on state and local regulations, site conditions, ground-water quality, and the ability for cross-contaminating or accelerating contamination movements among aquifer(s).

9.3.1 Large-diameter drill holes from rotary drill operation often require sealing. State, federal, and local regulations may dictate abandonment requirements for boreholes intersecting the water table.

9.3.1.1 The need for sealing of holes is also dependent on geohydrologic conditions. If the hole intersects the top of the first ground-water table, complete sealing may not be required. Under a homogeneous single aquifer system, where there are no perched water table or artesian conditions, there will be little hydraulic gradient to move potential contaminants at differing elevations. The worst case for possible cross-communication of aquifers occurs under perched or confined ground-water conditions.

9.3.1.2 In most cases, direct-push holes intersecting groundwater tables will require complete sealing. In cases where the hole is to be backfilled completely, the condition of the hole should be evaluated and documented. Any zones of caving or blocking which preclude complete sealing should be documented. Displacement grouting may displace ground water from the hole to the surface. If this water is considered contaminated then provisions must be made to collect these fluids at the surface. A minimum requirement for sealing should be that the surface of the hole is sealed to prevent hazards to those at the surface and to eliminate direct movement of surface contaminants to the water table through the hole.

9.3.2 Completion of Drill Holes—Completion of boreholes using drilling methods are addressed in Guides D 5781. D 5782. D 5783. D 5784. D 5785. D 5786. and also see 2.2.

9.3.3 Completion of Surface Direct-Push Holes—Several methods have been used successfully for sealing or grouting of surface direct-push holes (15). The method of grouting depends on the types of equipment deployed and the subsurface conditions encountered.

9.3.3.1 One method of grouting is retraction grouting directly through the sampler tip or friction reducer as the sampler is withdrawn after the sampling event. Tip retraction grouting is normally performed through small diameter tubes and a knockoff tip. Tip retraction grouting is the least frequently used due to difficulty in pumping grout mixtures without significant head loss through the tubing. Cement grouts for tip retraction grouting may require higher water content or additives to reduce viscosity.

9.3.3.2 Retraction grouting is sometimes performed through grouting points above the sampler tip. This is normally accomplished using an enlarged diameter grouting port above the sampler as shown in Fig. 7.

9.3.3.3 Reentry grouting may have an advantage of freeing pushing equipments for production while grouting operations follow. Reentry grouting allows temporary connection of aquifers between the removal and reinsertion process but is normally acceptable if grouting follows promptly minimizing exposure. The selection of retraction or reentry grouting is an economic decision and it depends on site conditions and depth of soundings.

9.3.3.4 In reentry grouting, Fig. 8 and Fig. 9, the test string is completely withdrawn from the hole and a secondary grouting tube or tubing is reinserted to the complete depth of the hole. If the hole remains open after retraction of the test string, inserting flexible tubing or small-diameter PVC into the hole by hand directly after testing may be possible. In this case, reinserting the grout line is desirable close to the original depth of the hole. In some cases, depending on project needs, locations of water bearing strata, and soil stratigraphy, it may be acceptable if the grout line does not reach the bottom of the hole.

9.3.3.5 Usually, with squeezing clays or caving sands, reaction equipment may be required to push rigid tubing of steel or plastic with a sacrificial or grouting tip to the complete



FIG. 7 Grouting Through Ports in Friction Reducers (15)

depth of the hole (Fig. 8 and Fig. 9). The reentry string should follow the original hole alignment because it is the path of least resistance. If deviation is suspected, it should be reported. If a knockoff tip is to be retracted in high hydraulic conductivity sands it may be necessary to add grout into rods prior to tip retraction to avoid water filling the rods. Grout is then pumped through the hole until it rises to the surface, or tremie grouting is performed by maintaining a grout column in the rods as they are removed. Grouting is continued to maintain a full hole as tubing is withdrawn. The simplest method of sealing a directpush hole in stable materials is to place dry materials by pouring or placing directly into the open hole after testing. This method is normally only acceptable in stable clay soils where the hole remains open after testing. This method is not acceptable if there are zones of hole caving or squeezing or there is appreciable presence of ground water in the hole. The holes can be probed with small-diameter rods to evaluate these conditions. Smalldiameter granular bentonite is normally used in this application.

9.3.3.6 Direct-push water sampling holes can be grouted with either cement or bentonite grouts. The grout consistency may have to be wetter than standard mixes used for sealing boreholes (Practice D 5092). There has been no research to confirm the best proportions. A typical mixture is 1 sack of Portland cement to 19 to 22 L (5 to 8 gal) of water. Bentonite is added in a small percentage, 2 to 5%, to reduce shrinkage. Typical bentonite-based mixtures consist of 22.7 kg of dry powered bentonite to 50 to 200 L (24 to 55 gal) of water. It is difficult to mix dry high-yield bentonite without good circulation equipment and time to allow for mixing and hydration. Pre-hydrated bentonite is easier to mix. Some bentonites contain additives that may not be acceptable for grouting use and the user should check with regulators to ensure sealing products are acceptable.

9.3.3.7 Record the volumes of grout injected and compare them with theoretical hole volumes. Often the grouting pressure at depth is unknown due to head losses through pipes, grout tubing, and connections. Pressure grouting equipments should at a minimum include a pressure gage at the surface. To avoid excessive hydraulic fracturing of the units, downhole pressures should be restricted to ¹/₂ psi per foot of hole depth. Record any unusual changes in grouting pressures that may suggest the presence of obstructions, caved zones, or occurrence of fracturing.

10. Field Report and Project Control

10.1 Report information recommended in Guide D 5434 and identified as necessary and pertinent to the needs of the exploration program. Information is normally required for the project. exploration type and execution, drilling equipment and methods, subsurface conditions encountered, ground-water conditions, sampling events, and installations. Some of the data collected during these investigations may be reported as data elements for describing ground-water sites (Guides D 5254, and D 5474).

10.2 Other information besides that mentioned in Guide D 5434 should be considered if deemed appropriate and necessary to the needs of the exploration program. Additional information should be considered as follows:



(a) Surface Injection (b) Flexible Tremie Tube (c) Rigid Tremie Pipe FIG. 8 Rigid Pipe with Internal Flexible Tremie Tube (15)



FIG. 9 Reentry with CPT Rods and Sacrificial Tip (15)

10.2.1 Drilling Methods—If rotary drilling methods are used for predrilling holes, report information particular to the drilling methods as outlined in Guides D 5781, D 5782, D 5783, D 5784, D 5785, D 5786, and also see 2.2.

10.2.2 Percussion Driving and Penetrometer Equipment— For equipment used for surface direct push, report the equipment type, make, model, and manufacturers. Report conditions during push of the sampler such as the occurrence of hard layers. Report datums established for monitoring depth of penetration. For combined cone penetrometers and watersampling devices, report cone-penetration information in accordance with Test Methods D 3441 and D 5778.

10.3 Sampling:

10.3.1 Equipment—Report the types of sampling equipment used including materials of manufacture of the components. Provide dimensions of the equipment including outside diameter, screen length and diameter, and friction reducers. Report methods for cleaning of the equipment before and after sampling. Note materials left in the hole or discarded between sampling events. Report any purging or development actions taken before the sampling event.

10.3.2 When water sampling is performed at the base of the borehole, report the condition of the base of the hole before sampling, and report any slough or cuttings present in the recovered sample.

10.3.3 During insertion of the sampler or well point, note any difficulties in advancing the point and retraction of a protective sleeve. Report the retraction distance for protectedscreen samplers. If the sampler cannot be advanced more than the minimum required distance of the sampler given in 8.1.4, report the distance driven. Note and record sampling depths including depths to the tip and midpoint of the well screen. Note any unusual occurrence during sampling such as fluid exposure, or evidence of cross-contamination contained in the samples recovered. Note and record the volume of the sample taken and other sample handling and preservation methods taken.

10.3.4 Report any measurements of water samples routinely performed in the field. These measurements may include temperature. PH. and conductivity. Report methods of testing, calibrations, and equipment used.

10.4 Completion and Installations—A description of completion materials and methods of placement. approximate volumes placed. intervals of placement. methods of confirming placement. and areas of difficulty or unusual occurrences.

11. Precision and Bias

11.1 The precision and bias of this method have not been established. Due to variability of subsurface conditions, comparative studies of differing approaches to direct-push sampling have not been statistically significant, because site spatial variability exceeded differences between methods (2). Comparisons between water samples obtained from direct-push samples and standard-monitoring wells have been favorable (11). Additional studies are needed and are actively pursued by Subcommittee D18.21.

12. Keywords

12.1 direct-push; water sampling; well point

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Standard Guide for Direct Push Soil Sampling for Environmental Site Characterizations¹

This standard is issued under the fixed designation D 6282; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide addresses direct push soil samplers, which also may be driven into the ground from the surface or through prebored holes. The samplers can be continuous or discrete interval units. Samplers are advanced by a combination of static push, or impacts from hammers, or vibratory methods, or a combination thereof, to the depth of interest. The guide does not cover open chambered samplers operated by hand such as augers, agricultural samplers operated at shallow depths, or side wall samplers. This guide does not address single sampling events in the immediate base of the drill hole using rotary drilling equipment with incremental drill hole excavation. Other sampling standards, such as Test Methods D 1586 and D 1587 and Practice D 3550 apply to rotary drilling activities. This guide does not address advancement of sampler barrel systems with methods that employ cuttings removal as the sampler is advanced. Other drilling and sampling methods may apply for samples needed for engineering and construction applications.

1.2 Guidance on preservation and transport of samples, as given in Guide D 4220, may or may not apply. Samples for chemical analysis often must be subsampled and preserved for chemical analysis using special techniques. Practice D 3694 provides information on some of the special techniques required. Additional information on environmental sample preservation and transportation is available in other references (1, 2).² Samples for classification may be preserved using procedures similar to Class A. In most cases, a direct push sample is considered as Class B in Practice D 4220 but is protected, representative, and suitable for chemical analysis. The samples taken with this practice do not usually produce Class C and D (with exception of thin wall samples of standard size) samples for testing for engineering properties, such as shear strength and compressibility. Guide D 4700 has some information on mechanical soil sampling devices similar to direct push techniques, however, it does not address most direct push sampling methods. If sampling is for chemical evaluation in the Vadose Zone. consult Guide D 4700 for any special considerations.

1.3 Field methods described in this guide, include the use of discreet and continuous sampling tools, split and solid barrel samplers and thin walled tubes with or without fixed piston style apparatus.

1.4 Insertion methods described include static push, impact, percussion, other vibratory/sonic driving, and combinations of these methods using direct push equipment adapted to drilling rigs, cone penetrometer units, and specially designed percussion/direct push combination machines. Hammers providing the force for insertion include drop style, hydraulically activated, air activated and mechanical lift devices.

1.5 Direct push soil sampling is limited to soils and unconsolidated materials that can be penetrated with the available equipment. The ability to penetrate strata is based on hammer energy, carrying vehicle weight, compactness of soil, and consistency of soil. Penetration may be limited or damage to samplers and conveying devices can occur in certain subsurface conditions, some of which are discussed in 5.5. Successful sample recovery also may be limited by the ability to retrieve tools from the borehole. Sufficient retract force must be available when attempting difficult or deep investigations.

1.6 This guide does not address the installation of any temporary or permanent soil, ground water, vapor monitoring, or remediation devices.

1.7 The practicing of direct push techniques may be controlled by local regulations governing subsurface penetration. Certification. or licensing requirements, or both, may need to be considered in establishing criteria for field activities.

1.8 The values stated in SI units are to be regarded as standard: however, dimensions used in the drilling industry are given in inch-pound units by convention. Inch-pound units are used where necessary in this guide.

1.9 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1.10 This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of

¹ This guide is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.21 on Ground Water and Vadose Zone Investigation.

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² The boldface numbers in parentheses refer to the list of references at the end of this standard.

a given professional service must be judged. nor should this document be applied without consideration of a projects's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.

2. Referenced Documents

2.1 ASTM Standards:

- D 420 Guide to Site Characterization for Engineering. Design and Construction Purposes³
- D 653 Terminology Relating to Soil. Rock and Contained Fluids³
- D 1452 Practice for Soil Investigation and Sampling by Auger Boring³
- D 1586 Test Method for Penetration Test and Split-Barrel Sampling of Soils³
- D 1587 Practice for Thin-Wall Tube Sampling of Soils³
- D 2488 Practice for Description and Identification of Soils (Visual-Manual Method)³
- D 3550 Practice for Ring-Lined Barrel Sampling of Soils³
- D 3694 Practices for Preparation of Sample Containers and for Preservation of Organic Constituents⁴
- D 4220 Practices for Preserving and Transporting Soil Samples³
- D 4700 Guide for Soil Sampling from the Vadose Zone³
- D 4750 Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitor Well (Observation Well)³
- D 5088 Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites⁵
- D 5092 Practice for Design and Installation of Ground Water Monitoring Wells in Acquifers⁵
- D 5299 Guide for Decommisioning of Ground Water Wells. Vadose Zone Monitoring Devices. Boreholes, and Other Devices for Environmental Activities⁵
- D 5314 Guide for Soil Gas Sampling in the Vadose Zone⁵
- D 5434 Guide for Field Logging of Subsurface Explorations of Soil and Rock⁵
- D 5730 Guide to Site Characterization for Environmental Purposes with Emphasis on Soil, Rock, the Vadose Zone, and Ground Water⁵
- D 5778 Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils⁵
- D 5783 Guide for Use of Direct Rotary Drilling with Water-Based Drilling Fluid for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices⁵
- D 5784 Guide for Use of Hollow-stem Augers for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality and Monitoring Devices⁵
- D 6001 Guide for Direct-Push Water Sampling for Geoenvironmental Investigations⁵

3. Terminology

3.1 Definitions—General definitions for terminology used in this guide are in accordance with Terminology D 653. Definitions for terms related to direct push water sampling for geoenvironmental investigations are in accordance with Guide D 6001.

3.1.1 assembly length, n-length of sampler body and riser pipes.

3.1.2 borehole, n-a hole of circular cross-section made in soil or rock.

3.1.3 casing, *n*—pipe furnished in sections with either threaded connections or bevelled edges to be field-welded, which is installed temporarily or permanently to counteract caving, to advance the borehole, or to isolate the interval being monitored, or combination thereof.

3.1.4 *caving/sloughing*, *n*—the inflow of unconsolidated material into an unsupported borehole that occurs when the borehole walls lose their cohesive strength.

3.1.5 *decontamination*. *n*—the process of removing undesirable physical or chemical constituents. or both, from equipment to reduce the potential for cross-contamination.

3.1.6 direct push sampling, n—sampling devices that are advanced into the soil to be sampled without drilling or borehole excavation.

3.1.7 extension rod. n—hollow steel rod. threaded. in various lengths. used to advance and remove samplers and other devices during direct pushing boring. Also known as *drive rod*. In some applications, small diameter solid extension rods are used through hollow drive rods to activate closed samples at depth.

3.1.8 incremental drilling and sampling, n-insertion method where rotary drilling and sampling events are alternated for incremental sampling. Incremental drilling often is needed to penetrate harder or deeper formations.

3.1.9 percussion driving, n—insertion method where rapid hammer impacts are performed to advance the sampling device. The percussion normally is accompanied with the application of a static down-force.

3.1.10 push depth. n—the depth below a ground surface datum to which the lower end. or tip. of the direct-push sampling device is inserted.

3.1.11 sample interval, n—defined zone within a subsurface strata from which a sample is gathered.

3.1.12 sample recovery, n—the length of material recovered divided by the length of sampler advancement and stated as a percentage.

3.1.13 soil core. n—cylindrical shaped specimen of sediments or other unconsolidated accumulations of solid particles produced by the physical and chemical disintegration of rocks and which may or may not contain organic matter recovered from a soil sampler.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 closed barrel sampler. n—a sampling device with a piston or other secured device that is held to block the movement of material into the barrel until the blocking device is removed or released. Liners are required in closed barrel samplers. Also may be referred to as a protected type sampler.

3.2.2 impact heads/drive heads. n—pieces or assemblies that fit to top of the above ground portion of the direct push tool assembly to receive the impact of the hammering device and transfer the impact energy to sampler extensions.

³ Annual Book of ASTM Standards, Vol 04.08.

⁴ Annual Book of ASTM Standards, Vol 11.02.

⁵ Annual Book of ASTM Standards, Vol 04.09.

3.2.3 open barrel sampler. n—sampling barrel with open end allowing material to enter at any time or depth. Also may be referred to as an *unprotected type sampler*.

3.2.4 *piston lock*. n—device to lock the sampler piston in place to prevent any entry of a foreign substance into the sampler chamber prior to sampling.

3.2.5 single tube system. n—a system whereby single extension/drive rods with samplers attached are advanced into the subsurface strata to collect a soil sample.

3.2.6 solid barrel sampler. n—a soil sampling device consisting of a continuous or segmented tube with a wall thickness sufficient to withstand the forces necessary to penetrate the strata desired and gather a sample. A cutting shoe and a connecting head are attached to the barrel.

3.2.7 split barrel sampler. n—a soil sampling device consisting of the two half circle tubes manufactured to matching alignment, held together on one end by a shoe and on the other by a connecting head.

3.2.8 two tube systems. n—a system whereby inner and outer tubes are advanced simultaneously into the subsurface strata to collect a soil sample. The outer tube is used for borehole stabilization. The inner tube for sampler recovery and insertion.

4. Summary of Guide

4.1 Direct push soil sampling consists of advancing a sampling device into subsurface soils by applying static pressure, by applying impacts, or by applying vibration, or any combination thereof, to the above ground portion of the sampler extensions until the sampler has been advanced to the desired sampling depth. The sampler is recovered from the borehole and the sample removed from the sampler. The sampler is cleaned and the procedure repeated for the next desired sampling interval. Sampling can be continuous for full depth borehole logging or incremental for specific interval sampling. Samplers used can be protected type for controlled specimen gathering or unprotected for general soil specimen collection.

5. Significance and Use

5.1 Direct push methods of soil sampling are used for geologic investigations, soil chemical composition studies, and water quality investigations. Examples of a few types of investigations in which direct push sampling may be used include site assessments, underground storage tank investigations, and hazardous waste site investigations. Continuous sampling is used to provide a lithological detail of the subsurface strata and to gather samples for classification and index or for chemical testing. These investigations frequently are required in the characterization of hazardous waste sites. Samples, gathered by direct push methods, provide specimens necessary to determine the chemical composition of soils, and in most circumstances, contained pore fluids (3).

5.2 Direct push methods can provide accurate information on the characteristics of the soils encountered and of the chemical composition if provisions are made to ensure that discrete samples are collected, that sample recovery is maximized, and that clean decontaminated tools are used in the sample gathering procedure. For purposes of this guide, "soil" shall be defined in accordance with Terminology D 653. Using sealed or protected sampling tools, cased boreholes, and proper advancement techniques can assure good representative samples. Direct push boreholes may be considered as a supplementary part of the overall site investigation or may be used for the full site investigation if site conditions permit. As such, they should be directed by the same procedural review and quality assurance standards that apply to other types of subsurface borings. A general knowledge of subsurface conditions at the site is beneficial.

5.3 Soil strata profiling to shallow depths may be accomplished over large areas in less time than with conventional drilling methods because of the rapid sample gathering potential of the direct push method. More site time is available for actual productive investigation as the time required for ancillary activities, such as decontamination, rig setup, tool handling, borehole backfill, and site clean-up is reduced over conventional drilling techniques. Direct push soil sampling has benefits of smaller size tooling, smaller diameter boreholes, and minimal investigative derived waste.

5.4 The direct push soil sampling method may be used as a site characterization tool for subsurface investigation and for remedial investigation and corrective action. The initial direct push investigation program can provide good soil stratigraphic information depending on the soil density and particle size, determine ground water depth, and provide samples for field screening and for formal laboratory analysis to determine the chemical composition of soil and contained pore fluids. Use of this method, results in minimum site disturbance and no cuttings are generated.

5.5 This guide may not be the correct method for investigations in all cases. As with all drilling methods, subsurface conditions affect the performance of the sample gathering equipment and methods used. Direct push methods are not effective for solid rock and are marginally effective in partially weathered rock or very dense soils. These methods can be utilized to determine the rock surface depth. The presence or absence of ground water can affect the performance of the sampling tools. Compact gravelly tills containing boulders and cobbles, stiff clay, compacted gravel, and cemented soil may cause refusal to penetration. Certain cohesive soils, depending on their water content, can create friction on the sampling tools which can exceed the static delivery force, or the impact energy applied, or both, resulting in penetration refusal. Some or all of these conditions may complicate removal of the sampling tools from the borehole as well. Sufficient retract force should be available to ensure tool recovery. As with all borehole advancement methods, precautions must be taken to prevent cross contamination of aquifers through migration of contaminants up or down the borehole. Regardless of the tool size, the moving of drilling and sampling tools through contaminated strata carries risks. Minimization of this risk should be a controlling factor in selecting sampling methods and drilling procedures. The user should take into account the possible chemical reaction between the sample and the sampling tool itself, sample liners, or other items that may come into contact with the sample (3, 4).

5.6 In some cases this guide may combine water sampling.

or vapor sampling. or both, with soil sampling in the same investigation. Guides D 6001 and D 4700 can provide additional information on procedures to be used in such combined efforts.

6. Criteria for Selection

6.1 Important criteria to consider when selecting sampling tools include the following:

6.1.1 Size of sample.

6.1.2 Sample quality (Class A.B.C.D) for physical testing. Refer to Practice D 4220.

6.1.3 Sample handling requirements, such as containers, preservation requirements.

6.1.4 Soil conditions anticipated.

6.1.5 Ground water depth anticipated.

6.1.6 Boring depth required.

6.1.7 Chemical composition of soil and contained pore fluids.

6.1.8 Probability of cross contamination.

6.1.9 Available funds.

6.1.10 Estimated cost.

6.1.11 Time constraints.

6.1.12 History of tool performance under anticipated conditions (consult experienced users and manufacturers).

6.2 Important criteria to consider when selecting direct push equipment include the following:

6.2.1 Site accessibility.

6.2.2 Site visibility.

6.2.3 Soil conditions anticipated.

6.2.4 Boring depth required.

6.2.5 Borehole sealing requirements.

6.2.6 Equipment performance history.

6.2.7 Personnel requirements.

6.2.8 Decontamination requirements.

6.2.9 Equipment grouting capability.

6.2.10 Local regulatory requirements.

7. Apparatus

7.1 General—A direct push soil sampling system consists of a sample collection tool, hollow extension rods for advancement, retrieval, and transmission of energy to the sampler, and an energy source to force sampler penetration. Auxiliary tools are required to handle, assemble and disassemble, clean, and repair the sample collection tools and impact surfaces. Necessary expendable supplies are sample containers, sample container caps, sample liners, sample retainers, appropriate lubricants, and personal safety gear.

7.2 Direct Push Tool Systems:

7.2.1 Two Tube System—An outer casing and an inner extension rod with a sampler attached (see Fig. 1) are advanced simultaneously into the soil for the length capacity of the sampler. The sampler is removed from the borehole and a new sampler barrel or plug bit is inserted for each increment of depth. Two-tube sampling systems also may incorporate sample gathering chambers that are fitted into the outer casing shoe. These sample barrels are designed to create a minimum of sample disturbance while gathering high quality specimens (see Fig. 2). Samplers are held in the proper position by different methods, such as extension rods, pneumatic or me-

chanical packers. spring activated latches. or other devices (see Figs. 1 and 2). Locking devices must be strong enough to hold the sampler while penetrating the sample strata. The outer casing supports the borehole wall. Sample retrieval is expedited by the cased hole and continuous sampling is simplified. Continuous sampling may be a benefit to lithological logging. A cased borehole can be sealed from the bottom up as the casing is extracted (see Section 10). A cased hole may reduce the risk of contamination migration down the borehole and sample cross contamination. The two-tube system is more susceptible to soil friction because of its larger diameter and may require larger direct push energy than single-tube systems. An oversized drive shoe is sometimes used to reduce friction and buckling but may increase the risk of contamination migration down the borehole.

7.2.2 Single Tube System—The single tube system (see Fig. 3), uses a hollow extension/drive rod to advance and retrieve the sampler. The sampler is attached to the bottom of the extension/drive rod. A drive cap is added to the top of the extension/drive rod and the sampler is pushed into the soil. Extension/drive rods generally are smaller in diameter than the sampler. The single tube system minimizes effort for discrete interval sampling under many subsurface conditions. Tool connection time per interval is reduced. Time of removal and reinsertion of samplers into the borehole is affected by soil conditions. Repeated movement of the sampler through contaminated subsurface strata may increase the risk of contamination migration down the borehole. Bottom up borehole sealing may require re-entry in soil formations that collapse (see Section 10).

7.3 Samplers:

7.3.1 Split Barrel Samplers-Split barrel samplers (see Fig. 4) are available for use with direct push drilling methods and are available in various sizes up to 3.0 in. (76.2-mm) inside diameter. The inside tolerance should allow for use of liners. Split barrel sampler shoes used in two tube systems must be of sufficient diameter to prevent the intrusion of soil between the outer diameter of the shoe and the inside wall of the outer tube. Split barrel shoes should be replaced when the leading edge is damaged. Damaged shoes can negatively affect sample recovery. Samplers can be used with or without ball check value fitted split barrel heads. The ball check prevents uphole fluids from flowing down through the sample. Where soil sampling will be performed below the water table, the split barrel head, equipped with a ball check, should be used. The open split barrel is best used with the two tube system because the outer casing protects the borehole against cave-in or sloughing, or in soils in which the borehole wall will not collapse. Split barrel sealing systems are available. Split barrel sections can be joined to create a sampler with a nominal sample length capacity of 48 in. (1.22 m). It is understood that samplers with usable lengths beyond 24 in. (0.61 m) are used to advantage in certain soil types: however, the added weight of the soil sample in the chamber and the added friction within the sampler may prevent loose soils from entering the sampler. affecting sample recovery and representativeness. Split barrel samplers can be fitted with a basket to improve recovery in cohesionless soils. Retainers are available in many styles and materials. Retainers

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FIG. 1 Split Spoon Sampling, Two Tube System

should allow the passage of softer soils. Stiff retainers can reduce specimen recovery in soft soils.

7.3.2 Solid Barrel Samplers:

7.3.2.1 Open Solid Barrel Samplers—Open solid barrel (see Fig. 5) samplers are used with all types of direct push sampling systems. Solid barrels can have inside diameters ranging up to 3 in. (76.2 mm). Barrel lengths range from 6 in. (152.4 mm) to 5 ft (1.53 m). Solid barrel samplers may be one piece or segmented. Sample liners should be used to facilitate removal of the sample from the solid barrel. Without the use of liners. samples are extruded mechanically. Liner lengths should fit sampler barrel lengths. Solid barrel samplers are generally

assembled with a removable cutting shoe and a drive head (see Fig. 6). The head provides a backing to hold the liner stationary while the sampler is advanced and serves as a connector to the extension/drive rods. The shoe is manufactured to hold the liner stationary during the soil collection procedure. The liner should be slightly larger than the inner diameter of the cutting shoe. It may be slipped over the cutting shoe (see Fig. 6) or nested inside of the cutting shoe (see Fig. 7). The shoe is manufactured to cut the sample to a slightly undersized diameter allowing it to pass into the sample liner with a minimum of side friction to reduce sample disturbance. The amount of specimen contact with the inside of the shoe should



FIG. 2 Sealed Sample Barrel, Single Tube System

be held to the minimum distance possible to aid in achieving the maximum amount of recovery.

7.3.3 Closed Barrel Sampler—Closed barrel samplers (see Figs. 2 and 3, Figs. 5-8) are devices, which remain sealed shut until an action is taken to open the sample receiving chamber. These samplers are used most often for single events (discrete point sampling) where a sealed sampler is required to avoid cross contamination or in circumstances where borehole wall stability cannot be assured. The shoe sealing device generally is a point designed to allow the continuous flow of soil around and past the sampler until such time as it is removed or released. The piston point can be fitted with seals, such as "O" rings at top and bottom to hold fluid out until sampling the desired interval. The piston rod extends through the sample retaining liner and must be released or removed for the soil to enter (see Fig. 3, Fig. 5, Fig. 7). The piston can be removed manually before sampling or be displaced by the soil entering

the sampler chamber. Using the displacement method can result in reduced recovery if sampled soils do not have sufficient strength to displace the piston. Pistons are locked in place by several methods, such as a spring loaded latch. The latch holds several balls (see Fig. 2, Fig. 7, Fig. 8) into a groove in the latch coupling. When the latch is released by lifting up on the latch stem, the balls slip back into the latch chamber allowing the piston to be removed. Another method uses a locking screw. A reverse thread pin (Fig. 3, Fig. 6) is positioned in the sampler head to prevent the piston from being displaced by the soil when advancing the sampler. At the sampling interval, small diameter extension rods are inserted through the sampler extension/drive rods and rotated clockwise to unscrew the locking pin. A third method uses an inflated packer. An inflated packer (see Fig. 9) is attached to the top of the sampler barrel. The sample barrel is lowered into position in the drive casing and the packer inflated. The packer is deflated to release



and the sample barrel is recovered after being advanced the sampling interval.

7.3.4 Thin Wall Tube—A 1.0-in. (25.4-mm) diameter thin wall tube (see Fig. 10) is available for use with direct push equipment and is manufactured according to Practice D 1587. Thin wall tubes can be effective when used with dual tube direct push systems as the borehole must be kept clear of disturbed soil prior to gathering a sample. Thin wall tubes may be effective in cohesive soils with single tube systems when the borehole can be kept clear of disturbed soil. Thin wall tubes must have an outside diameter that will allow passage through the outer casing. The thin wall tube can be operated in accordance with Practice D 1587, or it can be advanced using the percussion hammer of the direct push equipment. The primary use of the thin wall tube is to gather relatively undisturbed samples in cohesive soils. Sealing of thin wall tube

ends should be completed in accordance with Practice D 4220. Fixed piston apparatus (see Fig. 10) also is available for use with thin walled tubes. The fixed piston action allows the sampling of very soft formations, which may not be retained in conventional samplers. In certain soil formations, the thin wall tube provides the best method to collect an undisturbed sample.

7.3.5 Sampler Extension/Drive Rods—Sampler extension/ drive rods are lengths of rod or tube generally constructed of steel to withstand the pushing or percussion forces applied. Extension drive rods are available in various lengths. Rod lengths should be mated with casing and sampling equipment used. Thread types and classes vary between equipment manufacturers. Rod joints can be sealed to prevent fluid intrusion with "O" rings. Teflon[®] washers or Teflon[®] tape. Because of the percussive effort, joint seals should be checked for each sampling effort. Extension/drive rods should have



FIG. 4 Split Barrel Sampler, Two Tube System

sufficient inside diameter to accommodate the equipment necessary to perform the desired action.

7.3.6 Sampler Liners—Sampler liners are used to collect and store samples for shipment to laboratories. for field index testing of samples and for removing samples from solid barrel type samplers. Liners are available in plastics. Teflon⁽¹⁾, brass, and stainless steel. Other materials can be used as testing needs dictate. Liners are available in lengths from 6 in. (152.4 mm) to 5.0 ft (1.53 m). Liner material selection often is based on the chemical composition of liner/soil to minimize sample reaction with liner. Most liner use is short term as samples are subsampled and preserved immediately on site. A general rule for liner selection is stainless steel for organic compounds and plastic for metals. Teflon⁽¹⁾ may be required for mixed wastes and for long time storage. Liners should be sealed in accordance with Practice D 4220 when samples are collected for physical testing. Other appropriate procedures must be used when samples are collected for environmental analysis (see Practices D 3694) (1, 2). Liners generally are split in the field for subsampling. Individually split liners are available in some sizes for field use. The liner should have a slightly larger inside diameter than the soil specimen to reduce soil friction and



FIG. 5 (A) Open and (B) Closed Piston Sampler Assembly, Single Tube System

enhance recovery. When a slightly oversized liner is used, the potential for air space exists around the sample. Certain chemical samples may be affected by the enclosed air. Liners having less tolerance may be required and a shortened sampled interval used to reduce friction in the liner. Metal liners can be reused after proper cleaning and decontamination. Plastic liners should be disposed of properly after use.

7.3.7 Sample Containers—Sample containers should be prescribed according to the anticipated use of the sample specimen. Samples taken for chemical testing may require decontaminated containers with specific preservatives. Practice D 3694 provides information on some of the special containers

and preservation techniques required (1, 2). These containers generally will be decontaminated to specific criteria. Samples for geotechnical testing require certain minimum volumes and specific handling techniques. Practice D 4220 offers guidance for sample handling of samples submitted for physical testing.

7.4 Direct Push Power Sources—Soil probing percussion driving systems, penetrometer drive systems, and rotary drilling equipment may be used to drive casings and direct push soil sampling devices. The equipment should be capable of applying sufficient static force, or dynamic force, or both, to advance the sampler to the required depth to gather the desired sample. The system must have adequate retraction force to



FIG. 6 Sampler Parts, Single Tube System

remove the sampler and extension/drive rods once the selected strata has been penetrated. Rotation of the drill string can be added during insertion, as well as during retraction if the drive system can impart rotation.

7.4.1 *Retraction Force*—The retraction force can be applied by direct mechanical pull back using the hydraulic system of the power source: line pull methods using mechanical or hydraulic powered winches. or cathead and rope windlass type devices. Winches used with direct push technology should have a minimum of 2000 lb (907 kg) top layer rating capacity and a line speed of 400 ft (121.96 m)/min to provide effective tool handling. Direct push sampling tools can be retracted by back pounding using weights similar to those of standard penetration testing practices. Backpounding to recover samples can affect recovery and cause disturbances to the sample. Other forms of extraction, such as jacking, that do not cause undue disturbance to the sample, are preferable.

7.4.2 Percussion Devices-Percussion devices for use with



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FIG. 7 Closed Solid Barrel Sampler, Single Tube System

direct push methods are hydraulically-operated hammers, airoperated hammers, and mechanically-operated hammers. Hydraulically-operated hammers should have sufficient energy to be effective in moving the samplers through the subsurface strata. The maximum energy application is dependent on the tools used. Hammer energy that exceeds tool tolerance will result in tool damage or loss and will not achieve the goal of collecting high quality samples. Air-operated hammers should be capable of delivering sufficient energy, as well. Hammer systems utilizing hydraulic oil or air should be operated in the range specified by the manufacturer. Manually-operated hammers can be used to advance direct push tools. These hammers can be operated mechanically or manually using cathead and rope. These systems generally involve using 140 lb, standard penetration (see Test Method D 1586) hammers, which can work well for direct push sampling. In operation, these hammers tend to be slower than hydraulic hammers and can cause tool damage if direct push tools are not designed to take the heavy blows associated with these hammers. The hydraulic- and air-operated hammers strike up to 2000 blows/ min. In addition to the energy transferred, the rapid hammer action sets up a vibratory effect, which also aids in penetration.



FIG. 8 Closed Solid Barrel Sampler, Single Tube System

This vibratory effect, along with the percussive effort, may disturb some soil samples.

7.4.3 Static Push Systems—Cone penetrometer systems are an example of static push systems. They impart energy to the sampler and extension rods by using hydraulic rams to apply pressure. The pressure applied is limited to the reactive weight of the drive vehicle. Retraction of the sampler and extension rods is by static pull from the hydraulic rams.

7.4.4 Vibratorv/Sonic Systems—These systems utilize a vibratory device, which is attached to the top of the sampler extension rods. Reactive pressure and vibratory action are applied to the sampler extensions moving the sampler into the formation. In certain formations, sample recovery and formation penetration is expedited; however, all formations do not react the same to vibratory penetration methods.

7.4.4.1 Sonic or Resonance Drilling Systems—These are high powered vibratory systems that can be effective in advancing large diameter single or dual tube systems. They generally have depth capabilities beyond the smaller direct push systems.

7.4.5 Rotary Drilling Equipment—Direct push systems are readily adaptable to rotary drill units. The drill units offer a ready hydraulic system to operate percussion hammers, as well as reactive weight for static push. Because most drills are 4) D 6282



FIG. 9 Sampler Holding Methods, Two Tube System

equipped with leveling jacks. better weight application is achieved. Vertical pushing is improved because of the ability to level the machine. Tool handling is facilitated by high speed winches common to drilling rigs. extended masts for long tool pulls, and longer feed stroke length. Drill units with direct push adaptations also offer drilling techniques should obstacles be encountered while using direct push technology. Large drill units may have reactive weights that can exceed the tool capacity, thereby resulting in damaged tools.

8. Conditioning

8.1 Decontamination—Sampling equipment that will contact the soil to be sampled should be cleaned and decontaminated before and after the sampling event. Extension rods should be cleaned prior to each boring to avoid the transfer of contaminants and to ease the connecting of joints. Thread maintenance is necessary to ensure long service life of the tools. Sample liners should be kept in a sealed or clean

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FIG. 10 Thin Wall Tube Sampler, Two Tube System

environment prior to use. Reusable liners should be decontaminated between each use. All ancillary tools used in the sampling process should be cleaned thoroughly, and if contaminants are encountered, decontaminated before leaving the site. It should not be assumed that new tools are clean. They should be cleaned and decontaminated before use. Decontamination should be performed following procedures outlined in Practice D 5088 along with any site safety plans, sampling protocols, or regulatory requirements.

8.2 Tool Selection—Prior to dispatch to the project site an inventory of the necessary sampling tools should be made.

Sample liners. containers. sampling tools. and ancillary equipment should be checked to ensure its proper operation for the work program prescribed. Sampling is expedited by having two or more samplers on site. Since samples can be recovered quite fast. a supply of samplers will allow a boring to be completed so other functions can be performed while samples are being processed. A backup tool system adaptable to and within the capabilities of the power source should be available should the original planned method prove unworkable. Materials for proper sealing of boreholes should always be available at the site (5-7).

9. Procedure

9.1 While procedures for direct push soil sampling with two common direct push methods are outlined here, other systems may be available. As long as the basic principles of practice relating to sampler construction and use are followed, other systems may be acceptable.

9.2 General Set-Up—Select the boring location and check for underground and overhead utilities and other site obstructions. Establish a reference point on the site for datum measurements, and set the direct push unit over the boring location. Stabilize and level the unit, raise the drill mast or frame into the drilling position, and attach the hammer assembly to the drill head if not permanently attached. Attach the anvil assembly in the prescribed manner, slide the direct push unit into position over the borehole, save a portion of the sliding distance for alignment during tool advancement, and ready the tools for insertion.

9.2.1 Tool Preparation—Inspect the direct push tools before using, and clean and decontaminate as necessary. Inspect drive shoes for damaged cutting edges, dents, or thread failures as these conditions can cause loss of sample recovery and slow the advancement rate. Where permissible, lubricate rod joints with appropriate safe products, and check impact surfaces for cracks or other damage that could result in failure during operations. Assemble samples and install where required, install sample retainers where needed, and install and secure sampler pistons to ensure proper operation where needed.

9.2.2 Sample Processing-Sample processing should follow a standard procedure to ensure quality control procedures are completed. View sample in the original sampling device, if possible. Open the sampling device with care to keep disturbance to a minimum. When using liners or thin wall tubes. protect ends to prevent samples from falling out or being disturbed by movement within the liner. Measure recovery accurately, containerize as specified in the work plan or applicable ASTM procedures, and label recovered samples with sufficient information for proper identification. When collecting samples for volatile chemical analysis, sample specimens must be contained and preserved as soon as possible to prevent loss of these components. Follow work plan instructions or other appropriate documents (see Practice D 3694) when processing samples collected for chemical analysis.

9.3 Two Tube System:

9.3.1 Split Barrel Sampling (see Fig. 1)—Assemble the outer casing with the drive shoe on the bottom, attach the drive head to the top of the outer casing, and attach the sampler to the extension rods. Connect the drive head to the top of the sampler extension rods, and insert the sampler assembly into the outer casing. The sampler cutting shoe should contact the soil ahead of the outer casing to prevent unnecessary sample disturbance. The split spoon cutting shoe should extend a minimum of 0.25 in. (6.25 mm) ahead of the outer casing. Greater extensions may improve recovery in soft formations. Mark the outer casing and sampler assembly under the drill head, and move the drill head downward to bring pressure on the tool string. If soil conditions allow, advance the sampler/

casing assembly into the soil at a steady rate slow enough to allow the soil to be cut by the shoe and move up inside the sample barrel. If advancement is too rapid, it can result in loss of recovery because of soil friction in the shoe. Occasional hammer action during the push may help recovery by agitating the sample surface. If soil conditions prevent smooth static push advancement, activate the hammer to advance the sampler. Apply a continuous pressure while hammering to expedite soil penetration. The pressure required is controlled by subsurface conditions. Applications of excessive down pressure may result in the direct push unit being shifted off the borehole causing misalignment with possible tool damage. Stop the hammer at completion of advancement of the measured sampling barrel length. Release the pressure and move the drill head off the drive head. Attach a pulling device to the extension rods or position the hammer bail and retrieve the sampler from the borehole. At the surface remove the sampler from the extension rods and process. Soil classification is accomplished easily using split barrel samplers as the specimen is available readily for viewing, physical inspection and subsampling when the barrel is opened. Clean, decontaminate, and reassemble the sampler. Reattach the sampler to the extension rod, add the necessary extension rod and outer casing to reach the next sampling interval, and sound the borehole for free water before each sample interval. If water is present, it may be necessary to change sampling tools. Unequal pressure inside the casing may result in blow-in of material disturbing the soil immediately below the casing. Lower the sampler to its proper position, add the drive heads, and repeat the procedure. If it is desired that the pass through certain strata without sampling, install an extension rod point in lieu of the sampler. When the sampling interval is reached, remove the point and install the sampler. Advance the sampler as described. Upon completion of the borehole, remove the outer casing after instrumentation has been set or as the borehole is sealed as described in Section 10 (6).

9.3.2 Two Tube System—Other Samplers:

9.3.2.1 Thin Wall Tubes-Thin wall tubes (see Fig. 10) can be used with the dual tube system. Attach the tube to the tube head using removable screws. Attach the tube assembly to the extension rods and position at the base of the outer casing shoe protruding a minimum of 0.25 in. (6.25 mm) to contact the soil ahead of the outer casing. Advance the tube, with or without the outer casing, at a steady rate similar to the requirements of Practice D 1587. At completion of the advancement interval, let the tube remain stationary for 1 min. Rotate the tube slowly two revolutions to shear off the sample. Remove the tube from the borehole, measure recovery, and classify soil. The thin wall tube can be field extruded for on-site analysis or sealed in accordance with Practice D 4220 and sent to the laboratory for processing. Samples for environmental testing generally require the subsampling and preservation of samples in controlled containers. Soil samples generally are removed from the sampling device for storage and shipping. Thin wall tubes should be cleaned and decontaminated before and after use.

9.3.2.2 Thin Wall Tube Piston Sampler (see Fig. 11)— Check the fixed piston sampling equipment for proper operation of the cone clamping assembly and the condition of the

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FIG. 11 Fixed Piston Sampler, Two Tube System

sealing "O" rings. Slide the thin wall tube over the piston, and attach it to the tube head. Position the piston at the sharpened end of the thin wall tube just above the sample relief bend. Attach the sampler assembly to the extension rods, and lower the sampler into position through the outer casing. Install the actuator rods through the extension rod, and attach to the actuator rod in the sampler assembly. Attach a holding ring to the top of the actuator rod string, and hook the winch cable or other hook to the holding ring to hold the actuator rods in a fixed position. Attach the pushing fork to the drill head/probe hammer, and slowly apply downward pressure to the extension rods advancing the thin wall tube over the fixed piston into the soil for the sample increment. Rest sampler 1 min to allow sample to conform to tube. Rotate tube one revolution to shear off sample. Remove sampler assembly from borehole and process sample (6).

9.3.2.3 Open Solid Barrel Samplers-Use solid barrel samplers in advance of the outer casing where the soil conditions could cause swelling of split barrel samplers. or where friction against the outer casing precludes its advancement and sampling must still be accomplished. The solid, single, or segmented barrel sampler requires the use of liners for removal of the sample. The sampler must be cleaned and decontaminated before use. Use of the sampler follows the procedure described in 9.3.1.

9.4 Single Tube System:

9.4.1 Open Solid Barrel Sampler (see Figs. 5 and 6)-Attached the required liner to the cutting shoe by insertion into the machined receptacle area or by sliding over the machined tube. Insert the liner and shoe into the solid barrel, and attach the shoe (6, 8-11). Attach the sampler head to the sampler barrel providing a backing plate for the liner. Attach the sampler assembly to the drive rod and the drive head to the drive rod. Position the assembly under the hammer anvil and advanced as described in 9.3.1. At completion of the sampling increment, remove the sampler from the borehole. Remove the filled sample liner from the barrel by unscrewing the shoe, cap the liner for laboratory testing or spit open for field processing, and advance the borehole by repeating the procedure. Because the solid barrel cannot be opened for cleaning, it may require more effort for cleaning and decontamination. The open solid barrel sampler is used in soil formations that have sufficient wall strength to maintain a borehole wall without sloughing or cave-in. In soil formations not affording such structure, other sampling methods may be required or the opening sealed. To enhance recovery in some soil strata, it may be necessary to vary the length of the sampling increment. Shorter increments generally improve recovery because of lower sample friction and compression inside the sampler chamber. Sample recovery can be enhanced in some formations by intermittent use of the percussion hammer (6, 8, 10, 11).

9.4.2 Closed Solid Barrel Sampler (see Figs. 5-7, Fig. 11)-Insert or attach the sample liner to the shoe, and insert the assembly into the solid barrel sampler. Install sample retaining basket if desired. Attach the latch coupling or sampler head to the sampler barrel, and attach the piston assembly with point and" O" rings if free water is present. to the latching mechanism or holder. Insert the piston or packer into the liner to its proper position so the point leads the sampler shoe. Set latch, charge packer, or install locking pin, and attach assembled sampler to drive rod. Add drive head and position under the hammer anvil. Apply down pressure, hammer if needed, to penetrate soil strata above the sampling zone. When the sampling zone is reached, insert the piston latch release and recovery tool, removing the piston, or insert the locking pin removal/extension rods through the drive rods, turn counterclockwise, and remove the piston locking pin so the piston can float on top of the sample, or release any other piston holding device. Direct push or activate the hammer to advance the sampler the desired increment. Retrieve the sampler from the borehole by withdrawing the extension/drive rods. Remove the shoe, and withdraw the sample liner with sample for processing. Clean and decontaminate the sampler, reload as described, and repeat the procedure. Extreme stress is applied to the piston when driving through dense soils. If the piston releases prematurely, the sample will not be recovered from the correct interval, and a resample attempt must be made. The piston sampler can be used as a re-entry grouting tool for sealing boreholes on completion if it is equipped with a removable piston (5, 6, 7, 10, 11).

9.4.3 Standard Split Barrel Sampler—Attach the split spoon to an extension rod or drill rod. Using a mechanical or hydraulic hammer drive the sampler into the soil the desired increment, as long as that increment does not exceed the sampler chamber length. Remove the sampler from the borehole, disassemble, and process sample. Standard split barrel samplers can be used, as long as borehole wall integrity can be maintained and the additional friction can be overcome. If caving or sloughing occurs, the sampler tip should be sealed or other sampling tools used (9).

9.5 Quality Control:

9.5.1 *Quality Control*—Quality control measures are necessary to ensure that sample integrity is maintained and that project data quality objectives are accomplished. By following good engineering principles and applying common sense, reliable site characterizations can be accomplished.

9.5.2 Water Checks—Water seeping into the direct push casing or connecting rods from contaminated zones may influence testing results. Periodically check for ground water before inserting samplers into borehole or into outer casings in the two tube system. If water is encountered, it may be necessary to switch to the sealed piston type samplers to protect sample integrity. Sealed piston type samples may not always be water tight. Sealing of rod or casing joints can prevent ground water from entering through the joints.

9.5.3 Datum Points—Establishment of a good datum reference is essential to providing reliable sample interval depths and elevators. Select datum reference points that are sufficiently protected from the work effort, and that can be located for future reference. Field measurements should be to 0.1 ft (3.05 mm). Measure extension rods as the bore advances to locate sample depth. Mark rods before driving each sample interval to determine accurate measurement of sample recovery and to accurately log borehole depth.

9.5.4 Sample Recovery—Sample recovery should be monitored closely and results documented. Poor recovery could indicate a change in sampling method is needed, that improper sampling practices are being conducted, or that sampling tools are incorrect. Sample recovery involves both volume and condition. Poor sample recovery should cause an immediate review of the sampling program.

9.5.5 Decontamination—Follow established decontamination procedures. Taking shortcuts may result in erroneous or suspect data.

10. Completion and Sealing

10.1 Completion—For boreholes receiving permanent monitoring devices, completion should be in accordance with Practice D 5092, site work plan, or regulatory requirements.

10.2 Borehole Sealing—Seal direct push boreholes to minimize preferential pathways for containment migration. Additional information and guidance on borehole sealing can be found in Guide D 6001 and in Guide D 5299. State or local regulations may control both the method and the materials for borehole sealing. Regulations generally direct bottom up borehole sealing as it is the surest and most permanent method for complete sealing. High pressure grouting is available for use with direct push technology for bottom up borehole sealing.

10.2.1 Sealing by Slurry. Two Tube System-Sound the
borehole for free water. If water exists in the casing, place the extension rods, open-ended, to the bottom of the outer casing, as a tremie. Mix the slurry to standard specifications prescribed by regulation or work plan. Pump slurry through the extension/ drive rod until it appears at the surface of the outer casing. Remove the extension rods. If no free water exists in the borehole, the slurry can be placed by gravity. Top off the outer casing as it is removed from the borehole.

10.2.1.1 Slurry Mixes—Slurry mixes used for slurry grouting of direct push boreholes generally are of lower viscosity because of the small diameter tremie pipes required. Usable mixes are 6 to 8 gal (22.7 to 30.28 L) of water/94-lb (42.64-kg) bag of cement with 5 lb (2.27 kg) of bentonite or 24 to 36 gal (90.84 to 136.28 L) of water to 50 lb (22.68 kg) of bentonite.

10.2.2 Sealing by Gravity—Two Tube System—Measure the cased hole to ensure it is open to depth. Slowly add bentonite chips or granular bentonite to fill the casing approximately 2 ft. Withdraw the casing 2 ft and recheck depth. Hydrate the bentonite by adding water. Repeat this procedure as the outer casing is withdrawn. The bentonite must be below the bottom of the casing during hydration. Wetness inside the rods may affect the flow of granular bentonite to the bottom of the casing. Fill the top foot of the borehole with material that is the same as exists in that zone.

10.2.3 Borehole Sealing Single Tube System:

10.2.3.1 Gravity Sealing from Surface—If the soil strata penetrated has sufficient wall strength to maintain an open hole, then it may be possible to add sealing materials from the surface. Dry bentonite chips or granular bentonite can be placed by gravity. The borehole volume should be determined and the borehole sounded every 10 ft (3 m) to ensure bridging has not occurred. The bentonite should be hydrated by adding approximately 1 pt (0.57 L) of water for each 5 ft of filled borehole. Seal the surface with native material.

10.2.3.2 Wet Grout Mix Tremie Sealing—Tremie sealing methods can be used with single tube systems when borehole wall strength is sufficient to maintain an open hole or when extension rods with an expendable point are used to reenter the borehole. The grout pipe should be inserted immediately after the direct push tools are withdrawn or through the annulus of the extension rods that have been reinserted down the borehole for grouting. Care must be taken to not plug the end of the grout pipe. Side discharge grout pipes also can be used to prevent plugging.

10.2.4 Re-Entry Grouting—If the borehole walls are not stable, the borehole can be re-entered by static pushing grouting tools, such as an expendable point attached to the extension/drive rods to the bottom of the original borehole. Pump a slurry through the rods as they are withdrawn. High pressure grouting equipment may be beneficial in pumping standard slurry mixes through small diameter gravity pipes. Care must be taken to ensure the original borehole is being sealed.

11. Record Keeping

11.1 Field Report—The field report may consist of boring log or a report of the sampling event and a description of the sample. Soil samples can be classified in accordance with Practice D 2488 or other methods as required for the investigation (12). Prepare the log in accordance with standards set in Guide D 5434 listing the parameters required for the field investigation program. List all contaminants identified, instrument readings taken, and comments on sampler advancement. Record any special field tests performed and sample processing procedures beyond those normally used in the defined investigation. Record borehole sealing procedures, materials used, and mix formulas on the boring log. Survey or otherwise locate the boring site to provide a permanent record of its replacement.

11.2 Backfilling Record—Record the method of sealing, materials used, and volume of materials placed in each borehole. This information can be added to the field boring log or recorded on a separate abandonment form.

12. Keywords

12.1 decontamination: direct push; ground water: sealing; soil sampling

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SCIENCE APPLICATIONS INTERNATIONAL CORPORATION FIELD TECHNICAL PROCEDURE

Title: Chain-of-Custody

Procedure No: FTP-625	Revision: 0	Date: 8/30/96	Page 1 OF 10
Group Manager:	Date :	QA/QC Officer:	Date: 8/27/96

1.0 PURPOSE

The purpose of this procedure is to outline methods to ensure the integrity of environmental samples. from collection to final disposition, by documenting possession. The documentation traces possession of samples from their collection through all transfers of custody until final disposition, including archiving, when required.

2.0 <u>SCOPE</u>

This procedure applies to all sampling activities in which the samples leave the sampler's possession.

3.0 REFERENCES AND DEFINITIONS

- 3.1 <u>REFERENCES</u>
 - 3.1.1 Science Applications International Corporation Quality Assurance Administrative Procedures (SAIC QAAPs).
 - 3.1.2 Science Applications International Corporation Quality Assurance Program Plan (SAIC QAPP).
 - 3.1.3 Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual, U.S. Environmental Protection Agency, Region IV Environmental Services Division, Georgia, February 1, 1991.

3.2 DEFINITIONS

3.2.1 <u>Chain-of-Custody Form</u> - A form (usually pressure sensitive and duplicate or triplicate) used to document all transfers of possession of an environmental sample from time of collection until final disposition. A chain-of-custody form is identified by a unique number printed or entered on the form.

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- 3.2.2 Field Logbook A bound book with numbered pages containing at a minimum a table of contents, task team activity log sheets, and sample log sheets. Field logbooks are used to permanently record information pertaining to the actual sample collection event.
- 3.2.3 <u>Sample Container</u> Either an individual sample container, such as a bottle, or a shipping container, such as an ice chest, which may have or require an associated certification lot number.
- 3.2.4 <u>Sample Container Label</u> A waterproof paper or plastic, pressuresensitive, gummed label placed on the sample container bottle. Information regarding the sampling activity is recorded on the label, and the label is attached to the appropriate bottle.
- 3.2.5 <u>Sample Identification (ID) Number</u> A unique number assigned to a sample that is used to trace the sample from its origin to final reporting of data. Features of the ID may be used to identify the sampling location, installation type, sequential sample number, the media (air, water, or soil) sampled, or other pertinent descriptive information.

4.0 **RESPONSIBILITIES**

4.1 SAIC CORPORATE OFFICER IN CHARGE

The SAIC Corporate Officer in Charge is responsible for oversight of Chain-of-Custody activities.

4.2 GROUP MANAGER

The Group Manager is responsible for approving this procedure.

4.3 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) OFFICER

The QA/QC Officer is responsible for:

- 4.3.1 approving this procedure and
- 4.3.2 verifying that this procedure is being implemented.

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4.4	HEALT	H AND SAFETY (H&S) OF	FICER	
	The H& H&S po	S Officer is responsible for er licies and procedures are in e	isuring that appropria ffect and verifying sar	te SAIC and contractual me by line management.
4.5	PROG	RAM OR PROJECT MANA	GER	
	The Pr approp	ogram/Project Manager is riate procedures are followe	responsible for ens ed.	suring that this and all
4.6	FIELD	MANAGER		
	The Fie	eld Manager is responsible	for:	
	4.6.1	ensuring that all personnel with this procedure when it	perform their assign is applicable;	ed duties in accordance
	4.6.2	ensuring compliance with t	he Sampling and An	alysis Plan (SAP);
	4.6.3	overall management of fiel	d activities:	
	4.6.4	assuming custody of the c properly transfers them to a the laboratory.	ollected samples in a Sample Manager, t	the field until he or she to a courier, or directly to
	4.6.5	ensuring that sample cust collection until release to a	ody is maintained f courier or a laborati	rom the time of sample ory.
5.0 <u>GE</u>	NERAL			
5.1	It is SA to cher Safety require	AIC policy to maintain an effe mical, radiological, and physic y and Health Administra ements, Client specific (e.	ective program to con calstress which is con tion (OSHA) estat a Department of E	ntrol employee exposur isistent with Occupationa plished standards an Energy or Department o

5.2 Any deviations from specified requirements will be justified to and authorized by the Project Manager and/or the relevant Program Manager.

Defense) requirements apply on a project-specific basis.

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- 5.3 Deviations from requirements will be sufficiently documented to allow recreation of the modified process.
- 5.4 Refer to the site- or project-specific H&S Plan for relevant H&S requirements.
- 5.5 Refer to the site or project/task-specific SAP for relevant sampling and analysis requirements.
- 5.6 SAIC and subcontractor personnel who use this procedure must provide documented evidence of having been trained on the procedure to the Program or Project manager for transmittal to the CRF.
- 5.7 All field team members entering data will use indelible black ink. All entries must be legible. If an error is made, the field team member draws one line through the incorrect entry so that data is not obliterated, and initials and dates each correction. Dates and times are recorded using the format "mm/dd/yy" for the date and the military or 24-hour clock to record the time. Zeros in the sample identification number will be recorded with a slash (/) to distinguish them from the letter "O".

6.0 PROCEDURE

- 6.1 SAMPLES UNDER CUSTODY
 - 6.1.1 A sample is considered to be under a specific person's custody if any of the following conditions are met:
 - a) the sample is in the person's physical possession;
 - b) the sample is in line of sight of the person after he/she has taken possession;
 - c) the sample is secured by that person so any tampering can be detected; and
 - d). a sample is secured by the person in possession, in an area which only authorized personnel can enter.
 - 6.1.2 Chain-of-custody requirements are necessary whenever a sample leaves the sampling team's custody or when samples are collected and archived.

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6.2	SAMPLE L	ABELS		
	6.2.1 Sarr infor	ple container labels are mation.	e completed by e	ntering the required
	6.2.2 San of sa to fil	nple labels are affixed to a ampling. To the extent pra ling.	Il sample containers acticable, s ample b o	s prior to or at the time attles are labeled prior
	6.2.3 Lab folio	els are completed with bl wing information:	ack indelible ink an	d typically include the
	a) (b) (c) (d) (e) f) g) h) (i) j) k)	Unique field study or samp Unique sample identification sample location (station) of the sampling program; sample preservation used media sampled; sample type; analyses requested; destination laboratory nam sampling date and time; collector's name; and comments and special pro-	oling activity name a on number; or appropriate identif :: ne: ecautions as neede	nd/or number; fication as identified in d.
	6.2.4 Lat	els may be preprinted wi	th most of the inforr	nation.
6.3	SAMPLES	SEALS		
	6.3.1 Sar and	nple seals are used to de I prior to the time of analy	tect tampering follow sis.	wing sample collection
	6.3.2 The in c to e ice	e seal is attached in such a order to open the sample o either individual sample co chest.)	a way that it is nece container. ("Sample ntainers or a shippir	ssary to break the seal containers" may refer ig container such as an
	6.3.3 Se sar	als are affixed to the contannal.	ainers before they le	eave the custody of the

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6.3.4 Sa	nple seals will be waterpro	of paper or plastic v	vith gummed backs.
6.3.5 All will col	amples designated for shi have a sample seal affixed ected and the initials of the	pment which leave t I which includes the e person who collect	he sampler's custody date the sample was ted the samples.
6.3.6 Atte	rnately, evidence tape with	collector's initials a	nd date may be used.
6.4 FIELD LO	<u>BBOOKS</u>		
6.4.1 A fi the	eld logbook entry is made Chain of Custody number	at the time the sam	ple is taken to record
6.4.2 An spe	v additional Chain of Cust cific SAP or QAPjP is also	ody information rec entered in the field	quired by the project- logbook as required.
6.5 <u>CHAIN-O</u>	-CUSTODY FORMS		
6.5.1 The tim	e chain-of-custody form is c e of the sampling event.	ompleted by the sam	pling personnel at the
6.5.2 Th	chain-of-custody form inc	ludes the following	information:
a) b) c) d) e) f) g) h) i) j) k)	unique field study or samp sampling personnel signa unique sample identification analyses required for each date and time the sample sample media; comments regarding the s shipping information include method of shipment; and number of bottles/vials for signatures of person relific custody each time custor another; date and time of each trans	bling activity name a tures and printed na on number(s); h sample; was collected; sampling event; ding (1) number of si (3) special handling r each sample numb nquishing custody a dy is transferred fr	hipping containers; (2) requirements, if any. ber; and person accepting rom one individual to
6.5.3 If (ag a s	A samples are provided to ency, a separate chain-of- ampling team member wh	o another laboratory custody form will be lien the sample is tal	facility or government filled out in the field by ken.

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	6.5.4 C a	opies of chain-of-custody for nd/ or Data Management.	ms will be maintaine	d by the Field Manager		
	6.6 <u>DELIVE</u>	RY OF SAMPLES TO THE	LABORATORY			
	6.6.1 T C S	he field sampling team me ontainer for storage until a ampling activity.	mber places the sa Il samples have be	ample in an identified een collected for that		
	6.6.2 A n c fr	A Shipping Coordinator, Field Sampling Leader, or field sampling te member who ships samples from the field to the laboratory completes chain-of-custody form, including referencing all QC samples, signs form, and notes the date and time of shipment.				
	6.6.3 A	field sampling team member ccuracy. He or she makes	er inspects the form any needed correct	for completeness and ons.		
	6.6.4	field sampling team memb	er detaches the prop	per copies of the form.		
6.6.5 A field sampling team member places the ch reclosable plastic bag and tapes it to the insid sample shipping container is then sealed.				n-of-custody form in a of the cooler lid. The		
	6.6.6	The person who is going to de of the samples.	liver the samples to a	a courier takes custody		
		f the samples must be ship Coordinator or field samplin courier pickup or transports courier for overnight delivery airbill number and signs his or date, and time in the relinquis or she writes in the name of received by block.	pped to a distant la g team member an the sealed containe to the laboratory. Ther name and recor hed block on the cha the courier company	poratory, the Shipping ranges by phone for a ers to a commercial air He or she records the ds the company name, in-of-custody form. He y, date, and time in the		
	6.6.8	f a local laboratory will perf Shipping Coordinator, or a fie o the laboratory facility direct at the end of each day's sar Shipping Coordinator, or field ocal laboratory will relinquis and time the appropriate box	orm analysis, the F Id team member ma Ily from the field eithe mpling effort. The F d team member deliv h custody to the lab x on the chain-of-cu	ield Sampling Leader, y transport the samples or throughout the day or Field Sampling Leader, vering the samples to a oratory and sign, date, stody form.		

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6.6.9 If samples are not immediately transported to the analytical laboratory, they remain in the custody of the Shipping Coordinator or the Field Sampling Leader. All samples are stored under refrigeration with custody seals affixed. Keys to the secure area are kept by the Shipping Coordinator, Field Sampling Leader, or designee.

6.7 LABORATORY RECEIPT

- 6.7.1 Upon receipt of the samples at the laboratory, the laboratory receiving staff member signs his or her name, company name, date, and time in the received by block of the chain-of-custody form.
- 6.7.2 On the chain-of-custody form, the laboratory sample receiving personnel document the condition of the samples in regard to temperature, integrity of chain-of-custody seals, and proper preservation.
- 6.7.3 The laboratory personnel verify that information on the chain-of-custody form and labels is complete and accurate.
- 6.7.4 The laboratory follows chain-of-custody procedures as required by its Quality Assurance Plan. The laboratory may initiate a laboratory internal chain-of-custody form to track the sample throughout the laboratory process.
- 6.7.5 If problems are identified, the laboratory contacts the designated field contact to inform them of the type of problem and actions to prevent recurrence.
- 6.7.6 The laboratory provides a receiving report to the Project Manager or designee, which contains the information specified in the laboratory's Statement of Work or in the Sampling and Analysis Plan.

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7.0 <u>RECORDS</u>

As noted in this procedure, there are several items that are part of the system for documenting chain-of-custody. The following is a listing of all items that must be used to document chain-of-custody:

- a) chain-of-custody forms tracing possession of samples from their collection to final disposition;
- b) field logbooks documenting information pertaining to the actual sample collection event; and
- c) laboratory receiving report verifying receipt of samples and their requested analysis.

Documentation generated as a result of this procedure is collected and maintained in accordance with requirements specified in QAAP 17.1, Records Management.

8.0 ATTACHMENTS

8.1 Attachment I - Chain-of-Custody Form (Example)



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SCIENCE APPLICATIONS INTERNATIONAL CORPORATION FIELD TECHNICAL PROCEDURE

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Title: Field Quality Control

Procedure No: FTP-1200	Revision: 0) Date: 6/30/93	Page 1 of 6
Group Manager:	Date :	QA/QC Officer:	Date:
1.0 PURPOSE		······································	

The purpose of this procedure is to describe the steps necessary to ensure implementation of Field Quality Control (QC).

2.0 <u>SCOPE</u>

This procedure applies to samples collected as part of Science Applications International Corporation's (SAIC) field studies. It is established to ensure that samples meet the data quality objectives of the sampling event.

3.0 REFERENCES. RELATED READING, AND DEFINITIONS

3.1 <u>REFERENCES</u>

- 3.1.1 Environmental Surveillance Procedures Quality Control Program, Environmental and Safety Activities, Martin Marietta Energy Systems, January 31, 1990, Procedure ESP-400.
- 3.1.2 Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual, U.S. Environmental Protection Agency, Region IV Environmental Services Division, Georgia, February 1, 1991.
- 3.1.3 Science Applications International Corporation Quality Assurance Administrative Procedures (SAIC QAAPs).
- 3.1.4 Science Applications International Corporation Quality Assurance Program Plan (SAIC QAPP).
- 3.1.5 Science Applications International Corporation Environmental Project Management Manual (SAIC EPMM).

SAIC FIELD	Procedure No.:	Revision:	Page:		
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3.2 <u>DEFINITION</u> 3.2.1 <u>Field</u>	<u>NS</u> <u>QC I</u> - Verifies that field	activities are mee	ting established data		
4.0 <u>RESPONSIBILIT</u>	IES				
4.1 SAIC CORF	PORATE OFFICER IN CI	HARGE			
The SAIC C Quality Con	orporate Officer in Charg trol.	e is responsible for	oversight of Field		
4.2 <u>GROUP MA</u>	NAGER				
The Group	Manager is responsible fo	or approving this pro	ocedure.		
4.3 QUALITY A	SSURANCE/QUALITY (CONTROL (QA/QC	OFFICER		
The QA/QC	Officer is responsible for	•			
4.3.1 appr	oving this procedure;				
4.3.2 verif	ying that this procedure is	s being implemente	d; and		
4.3.3 assis obje	4.3.3 assisting the Program or Project Manager in determining the data quality objectives.				
4.4 <u>HEALTH A</u>	4.4 HEALTH AND SAFETY (H&S) OFFICER				
The H&S Of H&S policie line manag	The H&S Officer is responsible for ensuring that appropriate SAIC and contractual H&S policies and procedures are in effect and verifying enforcement of same by line management.				
4.5 PROGRAM	OR PROJECT MANAG	ER			
The Progra	m or Project Manager is	responsible for:			
4.5.1 ens	uring that all personnel a	re properly trained;			
4.5.2 ens	uring that this and all app	ropriate procedures	s are followed;		

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SAIC FIELD		Procedure No.:	Revision:	Page:
PROCEDUR	E	FTP-1200	0	3 of 6
	4.5.3 verify Centr	ing that the appropriate al Records Facility (CRF	training records a); and	are submitted to the
	4.5.4 deter	mining the data quality o	bjectives.	
5.0 <u>GENE</u>	ERAL			
5.1	It is SAIC po to chemical Department (OSHA) esta	licy to maintain an effective , radiological, and physic of Enery (DOE) and Occu ablished standards and r	ve program to contro cal stress which is ipational Safety and equirements.	ol employee exposure consistent with U.S. Health Administration
5.2	Any deviatio the Project f	ns from specified require Manager and/or the relev	ments will be justifie ant Program Mana	d to and authorized by ger.
5.3	Deviations creation of t	from requirements will he modified process.	be sufficiently docu	umented to allow re-
5.4	Refer to the	site- or project-specific +	1&S Plan for releva	nt H&S requirements.
5.5.	Refer to the	SAP for project/task-spe	cific sampling and a	analysis requirements.
5.6	SAIC and subcontractor personnel who use this procedure must provide documented evidence of having been trained on the procedure to the Program or Project Manager for transmittal to the CRF in accordance with subsection 4.5.3.			
5.7	Field QC in Field QC is considered input for the	volves first line inspectio a part of the field plan in evaluating field data a following areas in the pl	ns and verifications hing, and the result and analytical result anning stages:	of on-going activities. s of QC activities are s. Field QC provides
	5.7.1 the r	number and type of envir	onmental samples t	o be taken;
	5.7.2 the equi	number and type of Q(pment blanks, and trip bl	C samples (i.e., sa anks);	mple duplicates, field
	5.7.3 the c	criteria for sample verifica	ation; and	

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SAIC FIEL	D		Procedure No.:	Revision:	Page:
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	5.7.4 the suitability of field techniques to meet project QC goals in obtaining data of known defensible quality.				
5.8	Field (DC is j	orimarily applied to the fo	llowing phases of fi	eld work:
	5.8.1	1 sample collection, field measurements, and the ancillary tasks of label sample containers, cleaning equipment, and maintaining and calibrat instruments;			
	5.8.2	docu	mentation and sample co	ontrol; and	
-	5.8.3	samp	ole handling and shipmer	nt for analysis.	
5.9	A QA data c to the	VQC Officer assists the Program or Project Manager in determining the quality objectives for each field activity. The QA/QC Officer provides input a field activity planning staff in the following areas:			
	5.9.1	a review of the planned field techniques and the suitability (defined as practicality, economics, simplicity, versatility, and representativeness) of those techniques;			
	5.9.2	the r	number, types, and size o	of samples to be tak	en;
	5.9.3	the bian	number and type of same ks, and trip blanks to be	mple duplicates, fie prepared;	eld blanks, equipment
	5.9.4	the c	criteria for sample validat	ion;	
	5.9.5	i.9.5 the analytical parameters of interest, the sample containers to be used, the preservatives to be used, the holding time limitation, and the analytical methods to be used;			
	5.9.6	the o	decontamination procedu	ures for individual sa	ampling activities;
	5.9.7	the	ypes and quantities of sa	ampling equipment;	
	5.9.8	the	sample handling procedu	ures;	
	5.9.9	the	required instrument perfo	ormance criteria; an	d

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SAIC FIELD	Procedure No.:	Revision:	Page:			
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5.9.10 appro	opriate training of personr	nel.				
5.10 The require determined apparatus d field activitie	The required equipment and apparatus for specific field activities will be determined as described above. In addition to the required equipment and apparatus described above, the following items are required at the job site for field activities:					
5.10.1 logbo the r acce	5.10.1 logbook - the logbook will contain daily reports of the field activities and the results of QC inspections (variances, nonconformances, and acceptable findings);					
5.10.2 a cop and	5.10.2 a copy of the appropriate field documents for the specified field activity; and					
5.10.3 appro	opriate checklist and form	ns developed for fie	ld activity.			
5.11 The above or retained for	locuments are issued to sp the required period.	pecific users, secure	d when not in use, and			
5.11.1 Entri local	5.11.1 Entries are made in black waterproof ink in chronological order, with the local standard time in military format of each activity.					
5.11.2 All ei	ntries are signed by the p	erson making the e	entry.			
5.11.3 Mista	5.11.3 Mistakes are struck through once with ink, initialed, and dated.					
5.11.4 Entri activ and colle	5.11.4 Entries are completed and detailed enough to allow reconstruction of the activities at a later date. Data are carefully recorded in appropriate units and in sufficient detail to allow other workers to continue the data collection with the same degree of accuracy.					
5.11.5 All p	5.11.5 All pages are signed and dated.					
6.0 PROCEDURE						
6.1 QA/QC OF	QA/QC OFFICER EVALUATION					
6.1.1 The	QA/QC Officer will evalu	ate the following ar	eas:			
a) r	project documents for com he specific activities;	pleteness, complia	nce, and applicability to			

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\mathbf{C}	SAIC FII TECHNI PROCEI	ELD CAL DURE	Procedure No.: FTP-1200	Revision: 0	Page: 6 of 6
	6.	b) the tr c) the u proje d) the a e) the ap meas f) the a field a field a f.2.1 The (perfo a) va b) va c) va d) pi e) us f) pi g) co ni h) co i) ap j) lo k) da l) co m) ca n) th n	aining of field personnel; inderstanding by field per ct documentation requires ppropriateness of the equi- ppropriateness of the docur surement practices, and fi ppropriateness of checklis activities. <u>JDITS AND SURVEILLAR</u> DA/QC Officer ensures per rmed, as appropriate. Ite alidity or authenticity of the alidity of the field measure alidity of the field measure alidity of the field methodo roper documentation of field se of standard units in rep roper sample identification onformance to appropriate iques; Diformance to chain-of-cu- propriateness of the re- amples; gbook protocols and the ocumentation of equipme onformance with appropri- alculations and diagrams the corrective actions and onconformances.	ersonnel of required ments; lipment and instrum mentation of specific eld analytical process and inspection for <u>NCES</u> eriodic on site audit ms evaluated are: e samples; ement; blogy; eld events; borting field events; n; e sample handling a ustody procedures; equired number an agreement with act nt calibration; ate decontaminatio from field logbooks reports associated	d field practices and hents to be used; sampling procedures, edures; and orms for the specified s or surveillances are and preservation tech- d types of field QC ual samples; n procedures; ; and d with variances and
	7.0 <u>R</u>	ECORDS			
	D	ocumentation ge ccordance with i	enerated as a result of this requirements specified in	procedure is collec QAAP 17.1, Recor	ted and maintained in ds Management.
	8.0 <u>A</u> N	TTACHMENTS one.			

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SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Title: Packaging and Shipping of Environmental Field Samples

Date :

Procedure No: FTP-650 Revision: 0 Date: 8/30/96 Page 1 of 12

Anier C. Tilung :/27/96

1.0 PURPOSE

Group Manager:

The purpose of this procedure is to describe the minimum requirements to properly package containers of samples for transport.

QA/QC Officer:

C. A. Course

Date:

8/27/91

2.0 <u>SCOPE</u>

This procedure applies to samples collected in the course of environmental field investigations and monitoring activities.

3.0 REFERENCES, RELATED READING, AND DEFINITIONS

3.1 <u>REFERENCES</u>

- 3.1.1 Code of Federal Regulations, Title 40, Protection Of Environment.
- 3.1.2 Code of Federal Regulations, Title 49, Transportation.
- 3.1.3 Dangerous Goods Regulations. International Air Transport Assocation (IATA), latest revision.
- 3.1.4 Science Applications International Corporation, Quality Assurance Administrative Procedures (SAIC QAAP).
- 3.1.5 Science Applications International Corporation, Quality Assurance Program Plan (SAIC QAPP).
- 3.1.6 Science Applications International Corporation, Field Technical Procedures (SAIC FTP) 405, Cleaning and Decontaminating Sample Containers and Sample Equipment.
- 3.1.7 Science Applications International Corporation, Field Technical Procedures (SAIC FTP) 625, Chain of Custody.

3.2 DEFINITIONS

None.

4.0 **RESPONSIBILITIES**

4.1 GROUP MANAGER

The Group Manager is responsible for approving this procedure.

4.2 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) OFFICER

The QA/QC Officer is responsible for:

- 4.2.1 approving this procedure: and
- 4.2.2 verifying that this procedure is being implemented.

4.3 HEALTH AND SAFETY (H&S) OFFICER

The H&S Officer is responsible for ensuring that appropriate SAIC and contractual H&S policies and procedures are in effect and verifying enforcement of same by line management.

4.4 PROGRAM OR PROJECT MANAGER

The Program or Project Manager is responsible for:

- 4.4.1 designating a qualified person to train personnel who will be using this procedure;
- 4.4.2 ensuring that all personnel are properly trained;
- 4.4.3 ensuring that this and all appropriate procedures are followed;
- 4.4.4 verifying that the appropriate training records are submitted to the Central Records Facility (CRF); and
- 4.4.5 ensuring that the program/project has adequate and appropriate resources to be performed safely.

SAIC FIELD TECHNICAL PROCEDURE)	Procedure No.:	Revision:	Page:
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	4.5	FIELD MAN	AGER		
		The Field M	anager is responsible for		
		4.5.1 ensu with t	ring that all personnel per his procedure when it is a	form their assigned applicable:	d duties in accordance
		4.5.2 ensu	ring compliance with the	Sampling and Ana	llysis Plan (SAP);
		4.5.3 overa	all management of field a	ctivities: and	
		4.5.4 ensu	ring that sample packagi	ng and shipping is	performed safely.
5.0	<u>GEN</u>	IERAL			
	5.1	It is SAIC policy to maintain an effective program to control employee exposure to chemical, radiological, and physical stress which is consistent with Occupational Safety and Health Administration (OSHA) established standards and requirements. Client specific (e.g., Department of Energy or Department of Defense) requirements apply on a project-specific basis.			
	5.2	Any deviation the Project	ons from specified require Manager and/or the relev	ments will be justific ant Program Mana	ed to and authorized by ager.
	5.3	Deviations creation of t	from requirements will he modified process.	be sufficiently doo	cumented to allow re-
	5.4	Refer to the	site- or project-specific H	1&S Plan for releva	ant H&S requirements.
	5.5	SAIC and subcontractor personnel who use this procedure must provi documented evidence of having been trained on the procedure to the Progra or Project Manager for transmittal to the CRF.			ocedure must provide ocedure to the Program
	5.6	Receivers and carriers are to be contacted prior to packaging to ascertain an specific restrictions, such as weight limits, delivery and pick up schedule receiving hours, or sample disposal terms.			
	5.7	Individual s custody and	ample containers are c d analytical request form	hecked against a s prior to signing f	ccompanying chain-of- or receipt from sample

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SAIC FIELD TECHNICAL PROCEDURE		Procedure No.:	Revision:	Page:	
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5.8 Site samples are placed in strong exterior shipping packages and surrounded with compatible cushioning/absorbent material, if necessary.					
5.9 Th of rec to	5.9 The shipping package is labelled and marked in accordance with U.S. Department of Transportation (DOT) and/ or International Air Transport Association (IATA) regulations and carrier or receiver-specific instructions. DOT applies primarily to ground transport and IATA applies to air cargo transport.				
5.10 Th ap ap	e chain-o proved C propriate,	f-custody form must accord hain-of-Custody procedur and any required shippir	ompany the packag re. The package is o ng papers prepared	ge as specified in the closed and sealed, as	
5.11 Ar Att co	example tachment ntents info	(non-mandatory) Cooler III, which may be useful t prmation in a logbook.	Shipping Description for projects which re	on Log is provided as equire detailed cooler	
6.0 PROCE	DURE				
6.1 <u>S</u> /	MPLE C	LASSIFICATION			
Th se D(ie sample veral cate DT (49 CF	team leader classifies ea gories of hazardous mate R) and the IATA Danger	ach sample as envir erial/ dangerous go ous Goods Regulat	onmental or one of ods as defined by the ions.	
6. ⁻	1.1 Envir	onmental Samples			
	A sar ident Note are e	nple that does not meet th ified in this section is an : The vast majority of soil, nvironmental samples.	e criteria for any of th environmental samp groundwater, and s	ie nine hazard classes ble. surface water samples	
6.	1.2 Haza	ardous Materials/ Danger	ous Goods		
	A sai of ha requi the L	mple that meets the criter azardous materials/ dan irements of 49 CFR if a su ATA Dangerous Goods r	ia for one or more o gerous goods mus urface shipment or b egulations if an air s	f the following classes t be shipped per the by the requirements of shipment.	
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SAIC FIELD TECHNICAL		Procedure No.:	Revision:	Page:	
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	Note: shipp speci	There are additional r ing including hazardous r fic training every two yea	requirements beyor naterials awareness rs.	nd the mechanics of s, safety, and function	
	Class explo know explo	s 1. Explosives- any su de or capable of explo ledge that a sample conta sive compound(s) to m	bstance or article of ding. If the samp ains a sufficient quar eet this criterion, t	which is designed to ble team leader has ntity/concentration of he sample must be	
	shipped as an explosive. Note: Notification must be made to the Project Manager and Group H&S Officer prior to shipment or handling. Under no circumstances ship or otherwise handle explosive devices.				
	Class 2. Gases- cylinders of compressed gasses such as acetylene, nitrogen, air, oxygen, etc. Note: Field samples do not normally include compressed gases.				
	Class as ga more Note: a rea head	33. Flammable liquids-liquids-liquids-liquids-liquisoline , toluene, isopropy than 1% (10,000 ppm) of A useful field indicator the ding with a combustible g space of the sample con	uids with flash points I alcohol, or a mixtu f a flammable liquid hat a sample may be has indicator greater tainer.	less than 140°F such ure known to contain [49 CFR 173.120(ii)]. a flammable liquid is than 20% LEL in the	
	Class subst explo mate conta of the Note: encou unles made or ha	4. Flammable solids-sub ances which, in contact v sives, self reactive materia rials. If the sample tear ins a sufficient quantity/co se criteria, the sample m These are highly reac untered in an unreacted s samples are collected fr to the Project Manager ndling.	stances liable to spor with water, emit flam als, readily and sponta m leader has know brocentration of such bust be shipped as C tive materials and d state during env om intact containers and Group H&S Off	ntaneous combustion, mable gases- wetted aneously combustible ledge that a sample materials to meet any Class 4. will generally not be ironmental sampling a. Notification must be icer prior to shipment	
	Class swim mate may t	5. Oxidizing substances ming pool chlorine, that w rials and organic compou be considered as derivativ	and organic peroxid vill release oxygen ir nds containing the - ves of hydrogen per	es- materials such as a contact with organic O-O- structure which oxide (at greater than	

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1% concentration). If the sample team leader has knowledge that a sample contains a sufficient quantity/ concentration of such materials to meet either of these criteria. and has not previously reacted with materials in the immediate environment, the sample must be shipped as Class 5. Note: These are highly reactive materials and will not generally be encountered in an unreacted state in environmental sampling unless samples are collected from intact containers. Notification must be made to the Project Manager and Group H&S Officer prior to shipment or handling.

Class 6. Poisonous and infectious substances- materials with an acute oral LD₅₀ of not more than 500 mg/kg (liquid) or 200 mg/kg (solid) or a viable organism that causes or may cause disease in humans or animals. Note: Potentially poisonous samples are samples known to contain <u>percent</u> (not ppm) concentrations of mercury, tetrachloroethane, or other DOT defined poisonous materials. Potentially infectious substances are hospital (and related) wastes, and biological warfare agents.

Class 7. Radioactive materials- a material with > 0.002 μ Ci/gram. Note: A sample <u>may</u> meet the definition of radioactive material if it produces a radiological survey instrument reading (in counts per minute) in excess of 200% of regional background readings. Note that this is a conservative number and should be considered as a flag indicating the need for further investigation. Notification must be made to the Project Manager and Group H&S Officer prior to shipment.

Class 8. Corrosive material- materials capable of causing destruction or irreversible skin damage from a contact period of four hours or less. Note: Generally, this applies to materials with a pH of less than 2 or more than 12. DOT letters of interpretation specifically exclude preserved water samples from this class if the weight percent of preservative(s) in the samples is less than specified limits. (See Attachment I).

Class 9. Miscellaneous Hazardous Material- a material that has a property that would impair the performance of an aircraft crew member, a hazardous waste requiring a manifest, a hazardous substance that exceeds the reportable quantity in one package, and dry ice, among many other things.

Note: A soil or water sample containing unknown concentrations of contaminants does not meet this definition. Samples of a material that is known (identified) as hazardous waste do meet this definition. A sample preserved with dry ice also fits this class.

6.2 SAMPLE PACKAGING, LABELING, AND MARKING

6.2.1 Environmental Samples

Samples shipped to a laboratory for the purpose of testing are exempt from the requirements of 40 CFR 261 through 268 or Part 270 or Part 124 or the notification requirements of section 3010 of the Resource Conservation and Recovery Act (RCRA). Environmental samples will be packaged as follows:

- a) Clean exterior of filled sampled container (See FTP-405);
- b) Attach a label to the sample bottle:
- c) Seal the tops of bottles, except VOA vials, with appropriate tape or other secure fastening;
- d) Apply custody seals;
- e) Place each sample bottle in a plastic bag, squeeze as much air as possible from the bag, seal the bag;
- f) Prepare the shipping container (cooler) by taping the drain plug shut from the inside and outside, lining the cooler with a large heavy-duty plastic bag, and placing approximately 1 inch of packing material such as vermiculite, perlite, or bubble wrap in the bottom of the bag liner;
- g) Place the sample container upright in the cooler;
- h) Add sufficient ice to maintain the samples at the required temperature and include a temperature blank, when required;
- i) Fill the cooler with approrpiate sorbent/ padding;
- j) Tape the liner shut;
- k) Seal the laboratory paperwork inside a plastic bag and tape it to the inside of the cooler lid;
- I) Place signed custody seals on the front and back of the cooler; and
- m) Assure that the following information accompanies the samples: sample collector's name, mailing address, and telephone number, laboratory's name, mailing address, and telephone number, quantity of sample, date of shipment, and description of the samples.

Note: The steps described in a) through m) above are typical, but may be modified by the Field Operations Manager in accordance with a project-specific Sampling and Analysis Plan.

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6.2.2 Hazardous Materials/ Dangerous Goods/ Radioactive Materials

Packaging for samples of hazardous materials/ dangerous goods/ radioactive materials must meet the requirements for environmental samples as well as additional requirements of DOT and IATA (if the sample will be shipped by air).

Note: This procedure cannot address all the requirements of the regulations. Expert advice must be obtained prior to shipping hazarouds materials/ dangerous goods. Shipping firms such as Federal Express and UPS have hazardous materials/ dangerous goods departments which can provide specific guidance on packaging and other shipping requirements.

- a) Identify the appropriate packaging by referring to IATA Dangerous Goods Regulations (for air shipments) or 49 CRF (DOT) for surface shipments, or by contacting other sources such as the air carrier's hazardous materials department;
- b) Pack the sample(s) in the appropriate packaging;
- c) Mark each outer package with the proper shipping name, hazard class, packaging group, UN/ NA ID number, shipper's or consignee's name, address and telephone number, and "this end up" labels if inner containers hold liquid hazardous material; Note: Most of these marking requirements are fulfilled by the dangerous goods airbill.
- d) Affix a label indicating the DOT/ IATA hazard class on at least two sides of the package and next to the proper shipping name unless there is a limited quantity exemption.

6.3 ASSOCIATED DOCUMENTATION

6.3.1 Environmental Samples

Chain of Custody Record (See FTP-625) Custody Seal (See Attachment II) Sample Label (See Attachment III)

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6.3.2 Hazardous Materials/ Dangerous Goods

Bill of Lading- If the sample is hazardous materials/ dangerous goods, the hazardous materials/ dangerous goods bill of lading must be prepared in addition to the documents required for an environmental sample. Information on the bill of lading must include; identity of hazardous materials by proper DOT shipping description, the quantity of each hazardous material, emergency response information, the date, an emergency number (619-546-6965), the shipper, the carrier, and the consignee.

Note: The air carrier's dangerous goods airbill meets the requirements for the bill of lading.

7.0 RECORDS

Documentation generated as a result of this procedure is collected and maintained in accordance with requirements specified in QAAP 17.1, Records Management.

8.0 ATTACHMENTS

- 8.1 Attachment I Table 1, Limits of Water Sample Preservative Excluded from DOT Regulation
- 8.2 Attachment II Custody Seal and Sample Label (Examples)
- 8.3 Attachment III- Cooler Shipping Description Log (Example)

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Attachment I Table 1

Limts of Water Sample Preservative Excluded from DOT Regulation

(Water samples that fall within the categories below are not hazardous materials)

Preservative	Weight percent of preservative	Approximate pH ²	Approximate quantity added to water sample ³
HCI	≤ 0.04%	≥ 1.96	\leq 1.1 mL of conc. (38%)/ L
HgCl ₂	≤ 0.004%	NA	≤ 40mg/L
HNO ₃	≤ 0.15%	≥ 1.62	\leq 2.1 mL of conc. (70%)/ L
H₂SO₄	≤ 0.35%	≥ 1.15	≤ 2mL of 36 N/L
NaOH	≤ 0.08%	≤ 12.3	\leq 2mL of 10 N/L

- The DOT letters of interpretation exclude water samples from treatment as hazardous material if the weight percent of preservative is less than these concentrations. The numbers in this column are from the EPA regulations (40 CFR 136.3(e) footnote to Table II, revised April, 1994) because that is the reference quoted by DOT Hotline personnel.
- ² The EPA (40 CFR 136.3(e) footnote to Table II, revised April, 1994) provides these pH levels as corresponding with the maximum concentration of acid or base added to distilled water.
- ³ This column presents the quantity of preservative (calculated by SAIC) required to reach the DOT weight percent limits.

	SAIC FIELD TECHNICAL	Procedure No.:	Revision:	Page:			
\bigcirc	PROCEDURE	FTP-650	0	11 of 12			
		Attachmer	nt II				
		Sample Label (E	xample)				
	Sam	Lab: Southwest Labo 	ratory of 9 2 9				
		Station: B12ss-001 Media: Surface Soll Type: Grab Composite					
	Analysis: SVOC, Pest/PCB, Explosives Preserv: Cool, 4C						
	Rac	I Screen: lection Date/Time:					
	Comment:						
	,	Custody Seal (E	xample)				
	SECURITY S	EAL DATE_					
	DONOTIAN		S				

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IC FIELD CHNICAL	Procedure No.:	Revision:	Page:
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	Attachme (Exampl	nt III ie)	
	COOLER SHIPPING DI	ESCRIPTION LOG	nn Ann Ann an Ann a Ann an Ann an
PROJECT NAME:		PROJECT	NO
COOLER NO:	AIR BILL NO	DATE	3:
C	OOLER CONTENT I	NFORMATION	
TOTAL NUMBER O	F SAMPLES IN COOLER:	<u></u>	
ALL SAMPLES CLA	SSIFIED AS ENVIRONME	NTAL: YES	NO
IF NO, NUMBER OF	SAMPLES IN THE FOLL	OWING CATEGOR	IES:
Flammable liq	uid - DOT/IATA Class 3		
Poisonous ma	terial - DOT/IATA Class 6		
Radioactive m	aterial - DOT/IATA Class 7	7	
Corrosive mat	erial - DOT/IATA Class 8		
Hazardous wa	ste/substance - DOT/IATA	Class 9	
APPROVAL TO SHI	P: YES NO		
SIGNATURE:			

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SCIENCE APPLICATIONS INTERNATIONAL CORPORATION FIELD TECHNICAL PROCEDURE

Title: Documenting and Controlling Field Changes to Approved Work Plans					
Procedure No: FTP-1220	Revision:	0 Date: 02/23/96	Page T of 10		
Group Manager:	Date : 2/23/96	QA/QC Officer: C. A. Coward	Date: 02/22/96		
1.0 <u>PURPOSE</u> The purpose of this proce field changes to approve	edure is to estab ed work plans.	olish a method for documentir	ng and controlling		

2.0 <u>SCOPE</u>

This procedure applies to SAIC personnel and subcontractors involved in field efforts which are governed by an approved work plan. This procedure should be used and specified within the work plan when no other programmatic procedure for the completion of field changes exists.

3.0 REFERENCES, RELATED READING, AND DEFINITIONS

3.1 <u>REFERENCES</u>

None.

3.2 **DEFINITIONS**

- 3.2.1 Field Change: For the purposes of this procedure, a field change is a planned deviation from a procedure or requirement established in the approved workplan. Examples of typical field changes include the following:
 - a) A change in the number of samples to be collected.
 - b) A change in sample depth. location, or interval.
 - c) A change in method of sample collection.
 - d) A clarification to conflicting or confusing workplan or procedural requirements.
 - e) The discovery of unanticipated hazards or changes in site hazards, hazard monitoring, or hazard controls.
| | SAIC FIELD
TECHNICAL
PROCEDURE | | Procedure No.: | Revision: | Page: | | |
|------------|--------------------------------------|-------------------|--|--------------------------------------|------------------------|--|--|
| \bigcirc | | | FTP-1220 | 0 | 2 of 10 | | |
| | | 3.2.2 F | Field Change Request (FC
signature approval of the fi | R): A form used to re
eld change. | equest and document | | |
| | | 3.2.3 F | Field Change Control Log: A log used to track the status of requested field changes. | | | | |
| | | 3.2.4 F | Field Logbook: The site logbook, typically maintained by the Field
Team Leader, which summarily documents all project field activities. | | | | |
| | 4.0 <u>RES</u> | PONSIBILI | TES | | | | |
| | 4.1 | FIELD TE | MMEMBERS | | | | |
| | | Field Team | Id Team Members are responsible for: | | | | |
| | | 4.1.1 i | identifying items which may require field change; and | | | | |
| | | 4.1.2 0 | correctly implementing cha | anged procedures. | | | |
| | 4.2 | FIELD TEAM LEADER | | | | | |
| | | The Field T | Team Leader is responsible for: | | | | |
| | | 4.2.1 i | dentifying items which may | y require field chang | ge; | | |
| | | 4.2.2 p | properly completing the FC | R form prior to sub | mittal for approval; | | |
| | | 4.2.3 r | otifying the SAIC Project | Manager of the FCF | ז; | | |
| | | 4.2.4 0 | ompleting and maintaining | g the fiel <mark>d change c</mark> | ontrol log; | | |
| | | 4.2.5 r
a | naintaining updated copies
and | of FCRs with the fie | ld change control log; | | |
| | | 4.2.6 r | notifying affected field pers | onnel of approved l | FCRs. | | |
| | | | | | | | |
| | | | | | | | |

SAIC FIELD TECHNICAL PROCEDURE			Procedure No.:	Revision:	Page:	
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4.3	PROJ	<u>ECT N</u>	ANAGER			
	The P	roject l	Manager is responsible f	or:		
	4.3.1	obtair accor	ning concurrence from the dance with this procedur	e client th at field cha e;	nges may be made in	
	4.3.2	reviev projec	ving FCRs prior to submi ct team and Program Ma	ttal to the client and nager;	coordinating with the	
	4.3.3	Assu	ring that project Data Qu	ality Objectives are	not compromised;	
	4.3.4	deter budge	mining the effect of the F(et;	CR on the program/p	project objectives and	
	4.3.5	5 obtaining verbal approval for the FCR (at the discretion of the SAIC Project Manager, the Field Team Leader may obtain this approval);				
	4.3.6	submitting the FCR form to the client Project Manager for signature approval (at the discretion of the SAIC Project Manager, Field Team Leader may submit the FCR form for signature approval);				
	4.3.7	advising the client's Project Manager of the anticipated effects of the FCR;				
	4.3.8	ensuring that this procedure is followed; and				
	4.3.9	maint	aining a record copy of a	all FCRs.		
4.4	PROGRAM MANAGER					
	The Program Manager is responsible for:					
	4.4.1	assis accep	ting the Project Manager ptable to the client; and	with determining the	field change process	
	4.4.2	provid team	ding input as to the accer	otability of changes	requested by the field	

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	SAIC FIELD TECHNICAL PROCEDURE		Procedure No.:	Revision:	Page:		
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	4.5		SSURANCE/ QUALITY (
		The QA/QC	Officer is responsible for				
		4.5.1 app	roving this procedure;				
		4.5.2 con	curring with field changes	when requested; ar	nd		
		4.5.3 veri	ying that this procedure is	being implemented	i.		
	4.6	<u>GROUP N</u>	IANAGER				
		The Group	Manager is responsible f	or approving this pr	ocedure.		
	4.7	<u>CONTRAC</u>	TS MANAGER				
		The Contra	acts Manager, or designee	, is responsible for:			
		4.7.1 assi as t	sting the Project Manager o how field changes will be	r with obtaining agree proposed, approve	ement from the client ad and controlled; and		
		4.7.2 ass sco	isting the Project Manage pe.	er to assure that ch	langes are not out of		
	4.8	HEALTH AND SAFETY (H&S) OFFICERS					
		The Health and Safety Officer responsibilities are divided as follows:					
		4.8.1 The pre pro	e Site H&S Officer (SHS) paration of any FCR whi viding on-site training for t	 D) is responsible finite ch may affect heat he change made by 	or participating in the ith or safety, and for the FCR.		

4.8.2 The SAIC Health and Safety Officer (Group H&S Manager) is responsible for reviewing and approving FCRs which request or document changes in the H&S Plan, or which may affect the health or safety of the field team.

5.0 GENERAL

5.1 This procedure is intended to be used on field projects where a program process (e.g., client directed) for documenting, approving, and controlling changes to approved work plans is not in place.

SAIC FIELD		Procedure No.:	Revision:	Page:
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5.2	The Program if a client prod Plan.	Manager, Project Manag Cess is required. If not, this	er, and/or Contracts procedure is specifi	Managerdetermines ied in the project Work
5.3	The Program Contracts M and if this pr	m Manager or Project Manager, determines how ocedure is acceptable.	Manager in coording the client wants to p	nation with the SAIC process field changes

- 5.4 Verbal or signature approval for a FCR must be obtained from the client before the FCR is implemented.
- 5.5 A deviation from the requirements (cost. scope, milestone or method) of a project work plan or procedure, without an approved FCR or prior to approval of a FCR, constitutes a nonconformance and should be documented in a nonconformance report (NCR).
- 5.6 The Project Manager may designate a Field Change Coordinator, when necessary.

6.0 <u>PROCEDURE</u>

- 6.1 FCR Processing
 - 6.1.1 The Field Team Leader completes a FCR form (Attachment I) in accordance with paragraph 6.2 below and notifies the Project Manager.
 - 6.1.2 The Field Team Leader initiates an entry in the Field Change Control Log (Attachment II) by inserting the assigned FCR number, the date initiated, the status, the procedure number or work plan section (s) affected, and the name of the person requesting the changes.
 - 6.1.3 The original FCR or a copy is sent to the Project Manager and either the original or a copy is kept with the Field Change Control Log. The handling of original and copies is at the discretion of the Field Team Leader and Project Manager.
 - 6.1.4 The Project Manager discusses the FCR with appropriate members of the project team (QA/QC Officer, Program Manager, Contracts Manager, H&S Officer, field team members, etc.) and makes any corrections needed.

SAIC FIEL	כ ו	Procedure No.:	Revision:	Page:		
PROCEDU	RE	FTP-1220	0	6 of 10		
	6.1.5 If e a	the FCR includes a change ffect on the health or safet pprove the FCR.	e in the project H&S y of the field team, t	Planorhasapotential he H&S Officer must		
	6.1.6 T N o in N	he Project Manager or de lanagerand if required, oth r Health and Safety repre npacts of the request. The lanager for approval.	signee then notifies erclient staff such as sentative, of the sca FCR form is then se	s the client Project the QA representative ope, justification and ent to the client Project		
	N a a a	ote: To expedite the proc fter verbal client approval pproval is documented by nd in the Field Change C	cess, the changes n is obtained and do the Field Team Lead Control Log.	nay be implemented cumented. Verbal der in the field logbook		
	6.1.7 If (a a	the client Project Manage and no other approval is n pproved, and sent to the l stained by the Project Ma	r and others (if requi lecessary), the chai Field Team Leader. nager.	red) approve the FCR nge is signed as A record copy is		
	6.1.8 A is ir u c	fter the FCR form is signe inserted in the Field Char 6.1.3 above. The "Status pdated in the Field Chang hange is complete.	ed by the client, the f age Control Log in pl s" and "Date FCR Aj ge Control Log to in	form (original or copy) lace of the FCR noted oproved" columns are dicate that the field		
	6.1.9 A p fi	t the first opportunity, the ersonnel of the field chang eld logbook. If the FCR af otification of the changes	Field Team Leader ge. This notification fects health or safet in one or more site	notifies all affected is documented in the y, the SHSO includes safety briefings.		
6.2	COMPLETI	LETION OF THE FCR FORM				
	6.2.1 . F N	FCR NO An FCR number is assigned to the change request. Numbers are project coded and sequential.				
	6.2.2 D	ate Initiated- The date cha eld.	ange was first reque	ested is entered in this		

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<u> </u>	SAIC FIELD	Procedure No.:	Revision:	Page:			
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	6.2.4 C	ontract Number- The con perates.	tract number under	which the project			
	6.2.5 R cł si	equestor Identification- Pr nange, organization, phor gns in the signature bloc	int the n ame of the p ne number, and title k.	person requesting the . The requestor then			
	6.2.6 B cł in m	Baseline Identification- Check each affected baseline, i.e., does the change affect the cost of the project, is there an increase or decrease in scope, is an established milestone (due date) affected, or is one or more of the methods (procedures) used to conduct the work affected.					
	6.2.7 A et	ffected Document-Theex c. of the affected work pla	acttitle, revision nur an or procedure is e	nber, section number, entered in this field.			
<u>Х</u>	6.2.8 D fo pi	Description of Change- This field includes sufficient information for the reviewer to determine exactly how the affected work plan or procedure will be changed.					
an a	6.2.9 Jւ in	ustification- Include all rea clude reduction in cost. m	sons for the change inimization of health	e request. These may and safety risks, etc.			
	6.2.10 In ju m	npact of Not Implementing stification may be entered ay justify the change.	g Request- Often, th in this field. In some	he reciprocal of the ecases this statement			
	6.2.11 P ai cl	articipants Affected by Imp ffected. These may incluc hange, the data manager	lementing Request- le the field personn s. data users, subc	Include all participants el implementing the ontractors etc.			
	6.2.12 C ai T	ost Estimate- The Field T n estimate of the cost effe he person providing the c he appropriate phone num	eam Leader or Projects based on imple ost estimate signs in ober and date.	ect Manager includes menting the request. n this block and prints			
	6.2.13 P cl pi	revious FCR Affected- Ch necked, indicate the numb rovided to the right.	eck the appropriate per(s) of the previous	box. If the yes box is s FCR(s) in the space			

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7.0 <u>RECORDS</u>

Documentation generated as a result of this procedure is collected and maintained in accordance with requirements specified in QAAP 17.1, Records Management.

8.0 ATTACHMENTS

- 8.1 Attachment I- Field Change Request (FCR) form
- 8.2 Attachment II- Field Change Control Log form

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 	Attachment I Field Change Request	(FCR) Form	L 14
	Field Change Red	quest (FCR)	<u> </u>
FCR NO	-	DATE INITIATED	<u></u>
PROJECT			
CONTRACT NO			
REQUESTOR IDENTIF			
NAME	ORGANIZATION	PHONE	_
TITLE	SIGNATURE		
BASELINE IDENTIFIC, BASELINE(S) AFFECTI AFFECTED DOCUMEN DESCRIPTION OF CH	ATION ED O Cost O Scope (IT (TITLE, NUMBER AND SEC ANGE:	O Milestone O Met	hod of Accomplishn
BASELINE IDENTIFIC, BASELINE(S) AFFECTI AFFECTED DOCUMEN DESCRIPTION OF CH	ATION ED O Cost O Scope O IT (TITLE, NUMBER AND SEC ANGE:	O Milestone O Met	hod of Accomplishn
BASELINE IDENTIFIC, BASELINE(S) AFFECT AFFECTED DOCUMEN DESCRIPTION OF CH/ JUSTIFICATION:	ATION ED O Cost O Scope O IT (TITLE, NUMBER AND SEC ANGE:	O Milestone O Met	hod of Accomplishn
BASELINE IDENTIFIC, BASELINE(S) AFFECT AFFECTED DOCUMEN DESCRIPTION OF CH/ JUSTIFICATION:	ATION ED O Cost O Scope O IT (TITLE, NUMBER AND SEC ANGE: EMENTING REQUEST: TED BY IMPLEMENTING REC	O Milestone O Met	hod of Accomplishn
BASELINE IDENTIFIC, BASELINE(S) AFFECT AFFECTED DOCUMEN DESCRIPTION OF CH/ JUSTIFICATION: IMPACT OF NOT IMPLE PARTICIPANTS AFFEC COST ESTIMATE (\$)_	ATION ED O Cost O Scope O IT (TITLE, NUMBER AND SEC ANGE: EMENTING REQUEST: TED BY IMPLEMENTING REC ESTIMATOR SIGNA PHONE	O Milestone O Met	hod of Accomplishn
BASELINE IDENTIFIC, BASELINE(S) AFFECT AFFECTED DOCUMEN DESCRIPTION OF CH/ JUSTIFICATION: IMPACT OF NOT IMPLE PARTICIPANTS AFFEC COST ESTIMATE (\$)_ PREVIOUS FCR AFFE	ATION ED O Cost O Scope O IT (TITLE, NUMBER AND SEC ANGE: EMENTING REQUEST: TED BY IMPLEMENTING REC ESTIMATOR SIGNA PHONE CTED O YES O NO: IF Y	O Milestone O Met DUEST: TUREDATE ES, FCR NO	hod of Accomplishn
BASELINE IDENTIFIC, BASELINE(S) AFFECT AFFECTED DOCUMEN DESCRIPTION OF CH/ JUSTIFICATION: IMPACT OF NOT IMPLE PARTICIPANTS AFFEC COST ESTIMATE (\$)_ PREVIOUS FCR AFFE CLIENT PROJECT MA	ATION ED O Cost O Scope O IT (TITLE, NUMBER AND SEC ANGE: EMENTING REQUEST: TED BY IMPLEMENTING REC ESTIMATOR SIGNA PHONE CTED O YES O NO: IF Y NAGER	O Milestone O Met DUEST: TUREDATE ES, FCR NOD/	hod of Accomplishn

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ROCE	CEDURE FTP-1220 0			10 of 10				
	ATTACHMENT II FIELD CHANGE CONTROL LOG FORM							
		Field	Change Con	trol Log				
Progi Proje	ram ct Name		Con	tract No	Shee	t	_of	
FCR NO.	DATE INITIATED	STATUS	SOP. NO./WC	RKPLAN	REQUES	STOR	DATE FCR APPROVED	
					· ·			

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SCIENCE APPLICATIONS INTERNATIONAL CORPORATION FIELD TECHNICAL PROCEDURE

Date:

199/92

Title: Soil Sampling using an Auger

, un Auger

Revision: 0

Date:

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Date: 6/30/93

QA/QC Officer:

used to collect soil samples at the surface or in shallow excavations using an auger.

Group Manager:

1.0 PURPOSE

2.0 <u>SCOPE</u>

Procedure No: FTP-525

This procedure provides a disturbed sample. This procedure applies to a wide variety of soil types including sands, clays, and silts. The use of an auger is of limited value in rocky soil.

The purpose of this procedure is to describe the standard method and equipment

3.0 REFERENCES. RELATED READING, AND DEFINITIONS

3.1 <u>REFERENCES</u>

- 3.1.1 Environmental Surveillance Procedures Quality Control Program, Environmental and Safety Activities, Martin Marietta Energy Systems, Inc., January 31, 1990, Procedure ESP-303-2.
- 3.1.2 Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual, U.S. Environmental Protection Agency, Region IV Environmental Services Division, Georgia, February 1, 1991.
- 3.1.3 Science Applications International Corporation Quality Assurance Administration Procedures (SAIC QAAPs).
- 3.1.4 Science Applications International Corporation Quality Assurance Program Plan (SAIC QAPP).
- 3.1.5 Science Applications International Corporation Environmental Project Management Manual (SAIC EPMM).

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3.1.6	Scier (SAIC	ce Applications Internatio C FTP) 400, Equipment D	nal Corporation Fiek Decontamination.	d Technical Procedure	
3.1.7	Scier (SAIC	ce Applications Internatio C FTP) 1215, Use of Field	nal Corporation Field d Logbooks.	d Technical Procedure	
3.1.8	Scier (SAIC	nce Applications Internatio C FTP) 650, Packaging a	nal Corporation Field nd Shipping of Field	d Technical Procedure d Samples.	
3.1.9	Scier (SAI	nce Applications Internatio C FTP) 625, Chain-of-Cu	nal Corporation Field stody.	d Technical Procedure	
3.1.10	.1.10 Science Applications International Corporation Field Technical Procedure (SAIC FTP) 350, Groundwater Sampling Procedures: Well Installation, Development, and, Abandonment.				
3.2 DEFIN		<u>vs</u>			
3.2.1	<u>Hanc</u> typic conju	<u>d-Operated Auger</u> - A sm ally range between 1 and unction with 3 to 4 foot los	nall, lightweight, me d 4 inches. Augers ng metal shafts and	tal auger. Diameters normally are used in T-handles.	
3.2.2	3.2.2 <u>Motor-Operated Auger</u> - A metal auger attached to a shaft and powere by an internal combustion or electric motor. Typical auger diamete range from 1 to 48 inches. This auger may be hand held.				
4.0 <u>RESPONS</u>	BILIT	<u>IES</u>			
4.1 <u>SAIC</u>	CORF	PORATE OFFICER IN C	HARGE		
The S Samp	The SAIC Corporate Officer in Charge is responsible for the oversight of Soil Sampling using an Auger				
4.2 <u>GROL</u>	GROUP MANAGER				
The G	iroup	Manager is responsible 1	for approving this p	rocedure.	

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PROCEDU	AL JRE	FTP-525	0	3 of 7			
4.3	4.3 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) OFFICER						
	The QA/QC	Officer is responsible for	:				
	4.3.1 appr	oving this procedure and					
	4.3.2 verify	ving that this procedure is	being implemented	J.			
4.4	HEALTH A	ND SAFETY (H&S) OFFI	CER				
	The H&S Of H&S policie line manage	ficer is responsible for ensu s and procedures are in ef ement.	uring that appropriate fect and verifying en	e SAIC and contractual forcement of same by			
4.5	PROGRAM	AND PROJECT MANAG	GER				
	The Progra	m or Project Manager is I	esponsible for:				
	4.5.1 ensu	uring that all personnel an	e properly trained;				
	4.5.2 ensu	uring that this and all appi	opriate procedures	are followed; and			
	4.5.3 verif Cen	ying that the appropriate tral Records Facility (CRI	e training records =).	are submitted to the			
4.6	FIELD MAN	NAGER					
	The Field N	lanager is responsible fo	r:				
	4.6.2 ensu with	uring that all personnel pe this procedure when it is	rform their assigned applicable;	d duties in accordance			
	4.6.1 ensi	4.6.1 ensuring compliance with the Sampling and Analysis Plan (SAP); and					
	4.6.3 ove	rall management of field a	activities.				
5.0 <u>G</u> E	NERAL						
5.1	It is SAIC p to chemica	olicy to maintain an effect II, radiological, and phys	ive program to conti ical stress, which i	rol employee exposure s consistent with U.S.			

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SAIC I	SAIC FIELD TECHNICAL PROCEDURE		Procedure No.:	Revision:	Page:	
PROCI			FTP-525	0	4 of 7	
		Departmen Administratio	t of Energy (DOE) at on (OSHA) established s	nd Occupational tandards and requi	Safety and Health rements.	
	5.2	Any deviation by the Proje	ons from specified require ct Manager and/or the re	ements will be justif levant Program Ma	ied to and authorized nager.	
	5.3	Deviations to creation of t	from requirements will the modified process.	be sufficiently docu	mented to allow re-	
	5.4	Refer to the	site- or project-specific H	I&S Plan for relevar	nt H&S requirements.	
	5.5	SAIC and subcontractor personnel who use this procedure must provide documented evidence of having been trained on the procedure to the Program or Project Manager for transmittal to the CRF in accordance with subsection 4.5.3.				
	5.6	This proced may be use	lure is not appropriate fo d to take samples at an a	r taking samples at approximate depth.	a discrete depth, but	
	5.7	Sampling to prior to sar specified in	ools and equipment are p npling and decontamina FTP-400, Equipment De	protected from sour ted prior to, and b contamination.	rces of contamination etween sampling, as	
	5.8	The equipment required may include hand-operated, spiral-type, ship-type open tubular, orchard-barrel, open spiral, closed spiral, post hole, clam shel lwan, or machine-operated augers.				
	5.9	Augers plated with chrome or other materials, except Teflon, must be cleaned of those materials prior to use. Stainless steel is preferred.				
6.0	PRC	DCEDURE				
	6.1	SOIL SAM	PLING USING AN AUGE	<u>:R</u>		
		6.1.1 Don uten arou	clean gloves and using a sil, remove surface vege and the marked sampling	a stainless steel spo tation and debris fro point.	oon, or other approved om the immediate area	
		6.1.2 Use from	plastic sheeting around wo coming in contact with p	orkarea, as necessar potentially-contamin	y, to prevent equipment ated surfaces.	

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SAIC FIELD	Procedure No.:	Revision:	Page:	
PROCEDURE	FTP-525	0	5 of 7	
6.1.3 F	lecord the appropriate inforr ocation in the field logbook.	nation and observation	ons about the sample	
6.1.4 A	ssemble decontaminated aund advance the auger into t	ger.extension,and T ne soil to the desired	-handle, if necessary, I depth.	
6.1.5 V	Vithdraw the auger from the	soil.		
6.1.6 li 6 a ti	If a sample is not desired, remove the soil from the auger and repeat steps 6.1.3 & 6.1.4. If a sample is to be taken in the next boring, replace the auger bucket with a decontaminated bucket and repeat steps 6.1.2 through 6.1.4.			
6.1.7 F	erform any H&S measurem	ents as specified in t	the H&S plan.	
6.1.8 L r F ti N a	Ising a stainless steel Teff emove soil from the auger olyethylene sheet or a glass ne auger are discarded. Re flix or composite soil as dire pproved utensil, remove any forms, grass, leaves, roots,	on spoon, spatula, and place in a stain tray. The top two or move aliquot for vola cted by the SAP. Us large rocks or other etc.).	or disposable scoop iless steel bowl on a three inches of soil in atile organic analysis. sing a spoon or other organic material (i.e.,	
6.1.9 L c ii ii f	Ising a decontaminated statisposable scoop, as appro ontainers. Packaging, lab nplemented in accordance field Samples.	inless steel or Teflo priate, place soil sa eling, and preparati with FTP-650, Packa	on spoon, spatula, or imples in compatible on for shipment are aging and Shipping of	
6.1.10 S s a	amples are placed in contain pecified in the SAP, and the spossible.	ners defined accordi n, when appropriate,	ng to analytical needs packed in ice as soon	
6.1.11 l	changes in lithology are ob lan.	served, consult the s	ampling and analysis	
6.1.12 (v	Complete the field logbook a vith procedures, FTP-1215, I if-Custody.	and chain-of-custody Jse of Field Logbook	forms in accordance s and FTP-625,Chain-	

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SAIC FIELD	Procedure No.:	Revision:	Page:
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6.1.13 The hole is filled with materials approved by the SAP, Waste Management Plan or other applicable guidelines to avoid future safety problems. Excavated materials are placed in containers for disposal or dealt with as specified. Borehole is abandoned, if necessary, in accordance with FTP-350, Groundwater Sampling Procedures: Well Installation, Development, and Abandonment.

7.0 <u>RECORDS</u>

Documentation generated as a result of this procedure is collected and maintained in accordance with requirements specified in QAAP 17.1, Records Management.

8.0 ATTACHMENTS

8.1 Attachment I - Field Checklist

SAIC FIELD	Procedure No.:	Revision:	Page:	
PROCEDURE	FTP-525	0	7 of 7	
	Attachr Field Ch	nent I ecklist		
Auger		Labels and Tags		
Auger Shaft	s and Handles	Plastic Sheets		
Wrench		Lab Wipes		
Logbook		Decontamination Equipment		
Sample Con	tainers with Lids	Chain-of-Custody Forms		
Safety Glass Monogoggie	ses or S	Custody Seals or Evidence Tape		
Gloves		Sampling and Analysis Plan		
Safety Shoe	s	Health and Safety Plan		
Ice/Cooler, a	as required	Appropriate Containers for Waste and Equipment		
Black, Indeli	ble Pen	Monitoring Instruments		
Bowls	·	Spoons, Scoops, et	C.	

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SCIENCE APPLICATIONS INTERNATIONAL CORPORATION FIELD TECHNICAL PROCEDURE

Title: Soil Sampling Using a Spade or a Scoop

Procedure No: FTP-550	Revision: (Date: 6/30/93	Page 1 of 6
Group Manager:	Date :	QA/QC Officer:	Date: men 6/29/93

1.0 PURPOSE

The purpose of this procedure is to describe the standard method and equipment used to collect surface and near-surface soil samples using a spade or scoop.

2.0 <u>SCOPE</u>

This procedure is applicable for collection of disturbed soil samples up to a depth of approximately 20 inches, or from the sides and bottoms of larger excavations and trenches.

3.0 REFERENCES, RELATED READING, AND DEFINITIONS

3.1 <u>REFERENCES</u>

- 3.1.1 Environmental Surveillance Procedures Quality Control Program, Environmental and Safety Activities, Martin Marietta Energy Systems, Inc., January 31, 1990, Procedure ESP-300-1.
- 3.1.2 Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual, U.S. Environmental Protection Agency, Region IV Environmental Services Division, Georgia, February1, 1991.
- 3.1.3 Science Applications International Corporation Quality Assurance Administrative Procedure (SAIC QAAPs).
- 3.1.4 Science Applications International Corporation Quality Assurance Program Plan (SAIC QAPP).
- 3.1.5 Science Applications International Corporation Environmental Project Management Manual (SAIC EPMM).
- 3.1.6 Science Applications International Corporation Field Technical Procedure (SAIC FTP) 1215, Use of Field Logbooks.

SAIC FIELI TECHNICA	D L RE	Procedure No.:	Revision:	Page: 2 of 6
	nc	F1F-330		
	3.1.7 Scier (SAIC	ce Applications Internation C FTP) 400, Equipment D	nal Corporation Field Decontamination.	d Technical Procedure
	3.1.8 Scier (SAIC	nce Applications Internatio C FTP) 625, Chain-of-Cu	nal Corporation Field stody.	d Technical Procedure
3.2	DEFINITION	<u>15</u>		
	None.			
4.0 <u>RES</u>	PONSIBILIT	IES		
4.1	SAIC CORF	PORATE OFFICER IN CI	HARGE	
	The SAIC C Sampling U	orporate Officer in Charg sing a Spade or a Scoop	e is responsible for	oversight of Soil
4.2	GROUP MA	NAGER		
	The Group	Manager is responsible fo	or approving this pr	ocedure.
4.3	QUALITY A	SSURANCE/QUALITY (CONTROL (QA/QC) OFFICER
	The QA/QC	Officer is responsible for	•	
-	4.3.1 appr	oving this procedure and		
	4.3.2 verif	ying that this procedure is	s being implemente	d.
4.4	HEALTH A	ND SAFETY (H&S) OFF	ICER	
	The H&SOI H&S policie line manag	ficer is responsible for ensisted and procedures are in e ement.	uring that appropriat ffect and verifying e	e SAIC and contractual nforcement of same by
4.5	PROGRAM	1 OR PROJECT MANAG	ER	
	The Progra	m or Project Manager is	responsible for:	
	4.5.1 ensi	uring that all personnel a	e properly trained;	

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SAIC FIEL	D		Procedure No.:	Revision:	Page:
PROCEDU	RE		FTP-550	0	3 of 6
	4.5.2	ensu	ring that this and all appr	opriate procedures	are followed; and
	4.5.3	verify Reco	ing that the appropriate transformed second s	aining records are su	bmitted to the Central
4.6	FIELD	<u>) MAN</u>	AGER		
	The F	ield M	anager is responsible for	:	
	4.6.1	ensu with t	ring that all personnel per this procedure when it is	form their assigned applicable;	duties in accordance
	4.6.2	ensu	ring compliance with the	Sampling and Anal	ysis Plan (SAP);
	4.6.3	overa	all management of field a	ctivities;	
	4.6.4	classifying soil and rock samples, as required in the SAP (all classification must be performed by a geologist); and			
	4.6.5	direc	ting the packing and sea	ling of soil and rock	samples.
5.0 <u>GE</u>	NERAL	L			
5.1	It is SAIC policy to maintain an effective program to control employee exposure to chemical, radiological, and physical stress which is consistent with U.S. Department of Energy (DOE) and Occupational Safety and Health Administration (OSHA) established standards and requirements.				
5.2	Any c the P	leviatio roject	ons from specified require Manager and/or the relev	ments will be justifie vant Program Mana	d to and authorized by ger.
5.3	Devia creat	exiations from requirements will be sufficiently documented to allow re-			
5.4	Refe	er to the site- or project-specific H&S Plan for relevant H&S requirements.			
5.5	Refe requi	r to the remen	e site or project/task-speci hts.	fic SAP for relevant	sampling and analysis
5.6	SAIC	and mente	subcontractor personne	I who use this pro	cedure must provide cedure to the Program

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SAIC FIELD		Procedure No.:	Revision:	Page:			
PROCEDURE		FTP-550	0	4 of 6			
or 4.5	or Project Manager for transmittal to the CRF in accordance with subsectior 4.5.3.						
5.7 Sa pri sp	ampling to ior to sam pecified in I	ols and equipment are p pling, and decontamina -TP-400, Equipment Dec	protected from sour ited prior to and b contamination.	ces of contamination etween sampling, as			
5.8 As of	stainless s soil to the	eel, decontaminated gan required sample depth.	den spade is used to	remove the top layers			
5.9 Th ac	ne stainles stual soil sa	s steel or Teflon-lined de ample.	contaminated scoo	o is used to collect the			
5.10 Us ot	se only sta her materi	inless steel or Teflon-line als are not used.	ed spades. Spades	plated with chrome or			
5.11 Di ar	isposable nalytical pa	scoops may be used, arameters, in accordance	if appropriate, for with the SAP.	specified media and			
5.12 A	stainless	steel spoon may be subs	stituted for the scoo	D.			
6.0 <u>PROCE</u>	EDURE						
6.1 U wi	seplastics ith potentia	sheeting, as necessary, to ally contaminated surfac	prevent equipment es.	from coming in contact			
6.2 R in	lecord the a	appropriate information a ogbook.	nd observations abo	out the sample location			
6.3 D ai	on clean g nd surface	loves and use a decont material from immediate	aminated spade to r e area around mark	remove all vegetation ed sampling point.			
6.4 U S	lse the dec AP.	contaminated spade to re	emove soil down to th	he level specified in the			
6.5 N	leasure ar	nd record the depth to th	e sample with a rule	er or tape measure.			
6.6 U si tt	Jse a deco coil that ma he scoop o	ntaminated scoop or spo y have been in contact v or spoon does not contact	oon to remove a thir vith the spade and c ct the layer.	n layer, if necessary, of liscard. Take care that			

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SAIC FIEL TECHNICA PROCEDU	D NL RE	Procedure No.: FTP-550	Revision: 0	Page: 5 of 6
6.7 Obtain an appropriate volume of sample with a separate decontaminated sco or spoon. Use the spade or scoop to remove and discard any large rocks or oth organic material (i.e., roots, twigs, insects, worms, etc.) from soil samp Remove volatile organic compound sample, then homogenize sample thoroug as specified in the SAP. Fill sample jar to volume specified.				
6.8	Fill out samp specified in t	ble tag or label, put tag o the SAP. As soon as pos	r label on jar, and a ssible, store sample	apply custody seal, as es in ice.
6.9	An H&S rep Plan.	resentative will take the f	ield measurements	s required by the H&S
6.10	10 Use a new scoop or spoon for each sample taken. Don new clean gloves prior to beginning sampling activities at next sampling point.			
6.1	11 Complete the field logbook and chain-of-custody forms in accordance with procedures FTP-1215, Use of Field Logbooks and FTP-625, Chain-of-Custody.			
6.12	6.12 To avoid safety problems, fill the hole is filled with material in accordance with the SAP. Excavated materials are handled/disposed of as specified in the SAF Waste Management Plan or other applicable guidelines.			in accordance with the specified in the SAP,
7.0 <u>RE</u>	CORDS			
Doc acc	cumentation g ordance with	enerated as a result of thi requirements specified ir	s procedure is colle 1 QAAP 17.1, Recc	cted and maintained in ords Management.
8.0 <u>AT</u>	TACHMENTS	i		
8.1	Attachment	I - Field Checklist		
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SAIC FIELD	Procedure No.:	Revision:	Page:	
PROCEDURE	FTP-550	0	6 of 6	
	Attachr Field Ch	nent I ecklist		
Spade	i	Monitoring Instrume	ints	
Backhoe or I	Hand Tools	Labels and Tags		
Scoop		Plastic Groundsheets		
Ruler or Tap	e	Lab Wipes		
Logbook		Health and Safety Plan		
Sample Con	tainers, with Lids	Decontamination Equipment		
Safety Glass Monogoggie	ses or	Chain of Custody F	orms	
lce/Cooler, a	s required	Custody Seals or E	vidence Tape	
Gloves		Sampling and Analy	vsis Plan	
Safety Shoe	s	Appropriate Contair and Equipment	ers for Waste	
Black, Indelil	ole Pen			

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SCIENCE APPLICATIONS INTERNATIONAL CORPORATION FIELD TECHNICAL PROCEDURE

Title: Field Measurement Procedures: Turbidity

Procedure No: FTP-910	Revision: 0		Date: DRAFT	Page 1 of 5
Project Manager:	Date:	Proje	ct QA/QC Officer:	Date:

1.0 PURPOSE

The purpose of this procedure is to establish guidelines for the uniform calibration and use of the turbidity meter.

2.0 <u>SCOPE</u>

This procedure applies to all turbidity meters.

3.0 REFERENCES, RELATED READING, AND DEFINITIONS

3.1 <u>REFERENCES</u>

- 3.1.1 Environmental Surveillance Procedures Quality Control Program, Environmental and Safety Activities, Martin Marietta Energy Systems, Inc. January 31, 1990, Procedure ESP-300-1.
- 3.1.2 Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual, U.S. Environmental Protection Agency, Region IV Environmental Services Division, Georgia, February 1, 1991.
- 3.1.3 Science Applications International Corporation Quality Assurance Administrative Procedures (SAIC QAAPs).

FIELD	Procedure No.:	Revision:	Page:	
PROCEDURE	FTP-910	0	2 of 5	
3.2 DEFINI	TIONS			
3.2.1	ormazine-Standard solutio	n used in calibrating	g turbidity meters.	
3.2.2 <u>I</u> t	<u>ITUs</u> - Nephelometric Turbic Jrbuidity.	lity Units are the u	nits used to expre	SS
4.0 <u>RESPONSIE</u>	ILITIES			
4.1 <u>QUALI</u>	Y ASSURANCE/QUALITY) OFFICER	
The QA	/QC Officer is responsible for	or:		
4.1.1 a	pproving this procedure and	ł		
4.1.2 v	erifying that this procedure i	s being implemente	ed.	
4.2 <u>HEALT</u>	HAND SAFETY (H&S) OFF	ICER		
The H&S Officer is responsible for ensuring that appropriate SAIC and contractual H&S policies and procedures are in effect and verifying enforcement of same by line management.				
4.3 PROGE	AM OR PROJECT MANAG	ER		
The Pro	gram or Project Manager is	responsible for:		
4.3.1	approving procuedure;			
4.3.2 c	esignating a qualified pers rocedure;	on to train personr	nel that will use th	nis
4.3.3	nsuring that all personnel a	re properly trained;		
4.3.4	nsuring that this and all app	oropriate procedure	s are followed; and	Ł
4.3.5 v	erifying that the appropriat Central Records Facility (CR	e training records a F).	are submitted to t	he

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FIELD	Procedure No.:	Revision:	Page:		
PROCEDURE	FTP-910	0	3 of 5		
4.4 <u>FIELD</u>	MANAGER				
The Fie	eld Manager is responsible	for:			
4.4.1	ensuring that all personnel with this procedure when i	perform their assigned t is applicable;	I duties in accordance		
4.4.2	ensuring compliance with t	he Sampling and Ana	lysis Plan (SAP); and		
4.4.3	overall management of fie	d activities.			
5.0 <u>GENERAL</u>					
5.1 It is Sa exposu with the Health	5.1 It is SAIC policy to maintain an effective program to control employee exposure to chemical, radiological, and physical stress which is consistent with the U.S. Department of Energy (DOE) and Occupational Safety and Health Administration (OSHA) established standards and requirements.				
5.2 Any de by the be doc	viation from specified requestion from specified requested and/or to umented on the appropriated on the specified and th	irements will be justif ne relevant Program te field change forms	ied to and authorized Manager and should		
5.3 Deviati creatio	ons from requirements w n of the modified process	ill be sufficiently doc	umented to allow re-		
5.4 Referto	o the site- or project-specif	c H&S Plan for releva	nt H&S requirements.		
5.5 Referto	the SAP for project/task-s	pecific sampling and a	nalysis requirements.		
5.6 SAIC a docum Progra	and subcontractor person lented evidence of havir im or Project Manager for	nel who use this pro g been trained on t transmittal to the CR	cedure must provide he procedure to the F.		
5.7 The m page a	5.7 The manufacturer's operating instructions accompanied by a summary page are attached to this procedure for this instrument.				
5.8 Turbi scatter	dity measurements are ring method by using a gla	determined through a loss electrode.	the light- absorption-		

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6.0 <u>P</u> 6.0 6	DURE PROCEDURE 5.1 Choose 5.2 See the instruction Also note choice et 5.3 Check the instrume	FTP-910 an instrument that is consist manufacturer's operating ins prior to use. Operate the ons and note in the field log e in the field logbook the maxists. The last calibration date to a nt to the calibration lab if the	0 stent with investiga structions of Horiba he instrument as jbook which instru nethod of calibratio determine if it is o	4 of 5 tion requirements. a U-10 Water Quality per manufacturer's ment is being used on if more than one
6.0 <u>P</u> 6 6	5.1 Choose 5.2 See the instruction Also not choice et 5.3 Check the instrume	an instrument that is consist manufacturer's operating instrument to use. Operate the ons and note in the field log e in the field logbook the main kists.	stent with investiga structions of Horiba he instrument as jbook which instru nethod of calibration determine if it is o	tion requirements. a U-10 Water Quality per manufacturer's ment is being used on if more than one
6.0 <u>-</u> 6. 6.	 5.1 Choose 5.2 See the instruction 6.3 Check the instrume 	an instrument that is consist manufacturer's operating instrument to use. Operate the prior to use. Operate the ons and note in the field log e in the field logbook the nexists. The last calibration date to ent to the calibration lab if the	stent with investiga structions of Horiba he instrument as abook which instru- nethod of calibration determine if it is o	tion requirements. a U-10 Water Quality per manufacturer's ment is being used on if more than one
6	 5.1 Choose 5.2 See the instruction 6.3 Check the instrume 	an instrument that is consist manufacturer's operating ins prior to use. Operate the ons and note in the field log e in the field logbook the n xists. The last calibration date to o nt to the calibration lab if the	stent with investiga structions of Horiba he instrument as book which instru- nethod of calibration determine if it is o	tion requirements. a U-10 Water Quality per manufacturer's ment is being used on if more than one current Beturn the
6	 See the inchecker Checker Instruction Also note choice et Check the instrume 	manufacturer's operating ins prior to use. Operate the ons and note in the field log e in the field logbook the n kists. The last calibration date to o nt to the calibration lab if the	structions of Horiba he instrument as abook which instru nethod of calibration determine if it is o	a U-10 Water Quality per manufacturer's ment is being used on if more than one
6	5.3 Check th instrume	ne last calibration date to an to the calibration lab if the	determine if it is a	current Return the
6			e calibration is out	of date.
0.	6.4 Record r	neasurements in the approp	oriate field logbook	•
7.0 <u>B</u>	RECORDS			
D in	Documentatio n accordance	n generated as a result of thi with requirements specified	s procedure is colle d in QAAP 17.1, Re	ected and maintained ecords Management
8.0 <u>A</u>		TS		
8	3.1 Attac	hment I - Field Checklist		
8 e	3.2 Attac each	hment II - manufacturer's project requirement	operating instruction	ons are attached for

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FIELD TECHNICAI	Procedure No.:	Revision:	Page:			
PROCEDURE	FTP-910	0	5 of 5			
Attachment I Field Checklist						
Appropriate	AppropriateTurbidity Instruments					
Calibration S	Calibration Standard/check source					
Safety Glass	ses or Monogoggies*					
Gloves⁺	Gloves*					
Safety Shoe	Safety Shoes*					
Logbook						
Black Indelik	Black Indelible Pen					
Sampling ar	Sampling and Analysis Plan					
Health and S	Health and Safety Plan					
Manufacturer's Instrument Calibration and Maintenance						
Decontamination Equipment						
*When specifie	*When specified by the site-specific H&S plan.					

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SCIENCE APPLICATIONS INTERNATIONAL CORPORATION FIELD TECHNICAL PROCEDURE

Title: Use of Field Logbooks

Procedure No: FTP-1215	Revision: (Date: DRAFT	Page 1 of 35
Group Manager:	Date:	QA/QC Officer:	Date:

1.0 PURPOSE

The purpose of this procedure is to present minimum requirements for the creation, content specifications, completion, review, and storage of field logbooks during environmental sampling activities.

2.0 <u>SCOPE</u>

This procedure applies to all types of field logbooks used to support and document environmental sampling activities. This procedure provides guidance to the minimum requirements for logbook content.

3.0 REFERENCES, RELATED READING, AND DEFINITIONS

3.1 <u>REFERENCES</u>

- 3.1.1 Science Applications International Corporation Quality Assurance Administrative Procedures (SAIC QAAPs).
- 3.1.2 Science Applications International Corporation Quality Assurance Program Plan (SAIC QAPP).
- 3.1.3 Science Applications International Corporation Environmental Project Management Manual (SAIC EPMM).
- 3.1.4 U.S. Department of Energy (DOE) Order 5700.6C, Quality Assurance.
- 3.1.5 American Society of Mechanical Engineers (ASME) NQA-1-1989, Quality Assurance Program Requirements for Nuclear Facilities.
- 3.1.6 "Controlling and Documenting Field Changes to Approved Plans," Environmental Restoration Program Division Procedure ERWM/C-2303, Martin Marietta Energy Systems, Inc., Oak Ridge, Tennessee, July 19, 1995.

SAIC FIELD TECHNICAL PROCEDURE		Procedure No.:	Revision:	Page:
		11641213	U	20133
3.1.7	Data Envir Appli	Management Plan for the onmental Restoration P cations International Corp	ne Oak Ridge K-25 rogram Assessmer poration, Septembe	Site and Y-12 Plant nt Activities, Science r 1992.
3.1.8	Oak f Data Syste	Ridge Gaseous Diffusion F Management Plan, K/H ems, Inc., Oak Ridge. Ter	Plant (ORGDP) Rem S-232 (Rev. 1), Ma nnessee, April 1989	nedial Action Program artin Marietta Energy
3.1.9	Stand 100 (I Marti	dard Operating Procedure Rev. 0), Hazardous Waste n Marietta Energy System	es for Site Characte Remedial Actions P s. Inc., Oak Ridge, T	rizations, DOE/HWP- rogram (HAZWRAP), ennessee, July 1990.
3.1.1	0 U.S. EH-0 Augu	Department of Energy, T 053. Appendix I, Sample st 1987.	he Environmental S and Document Ma	Survey Manual, DOE/ nagement Guidance,
3.1.1	I U.S. Field Emer D.C.,	Environmental Protectior Operations Methods, EPA gency Response (OSW December 1987.	n Agency, A Compe N540/P-87-001, Offi /ER) Directive 935	endium of Superfund ice of Solid Waste and 5.0-14, Washington,
3.1.1:	2 U.S.E and Enfor Wast	Environmental Protection / Recovery Act (RCRA) cement Guidance Docur hington, D.C., September	Agency,OSWER, Re Ground-Water M nent (TEGD), OSW 1986.	esource Conservation Ionitoring Technical /ER Directive 9950.1,
3.1.1	3 U.S. Solid Meth	Environmental Protection Waste, Third Edition, V ods, SW-846, Washingto	n Agency, Test Me 'ol. II. Field Manua n. D.C., November	thods for Evaluating II, Physical/Chemical 1986.
3.2 <u>DEFI</u>	NITION	<u>IS</u>		
3.2.1	<u>Corre</u> meas	elation of Field Test Data surements obtained by m	ta - Comparison o ore than one metho	f any av ailable field id.
3.2.2	<u>Envir</u> envir	onmental Sample - Solid onmental measuring and	, liquid, or gas sa monitoring.	amples collected for
3.2.3	<u>Field</u> to pro obse	Logbook - A bound and se wide a real-time, perman vations, and measuremen	equentially numbere ent record of activiti its taken at an investig	d logbook that is used es, significant events, gation site. Depending

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	Procedure No.:	Revision:	Page:		
PROCEDURE	FTP-1215	0	3 of 35		
on the intended use of the logbook. it will contain, at a minimum, a title sheet and appropriate field data collection/documentation forms.					
3.2.4 <u>F</u> Ic	Field Logbook Table of Contents - Pages located at the front of the field logbook used to index the contents.				
3.2.5 <u>k</u> a re	Identification of Anomalous Field Test Data - Identification of any abnormal or unusual field test data and evaluation of the impact of the results on the associated environmental data.				
3.2.6 <u>la</u> ra e ir	3.2.6 <u>Identification of Valid Samples</u> - Interpretation and evaluation of field records to detect problems affecting the representativeness of environmental samples. Any environmental data associated with poor or incorrect field work is identified and documented.				
3.2.7 (c e k c a v	Quality Assurance (QA) Roompleteness, legibility, on ntries. The QA review ogbook pages are comple r more persons who are nd are knowledgeable of vill sign and date to document	view - The process of onsistency, and clarity s completed as soon ed and is conducted an ndependent of the ac the project requirement nent concurrence.	verifying the accuracy, y of the field logbook as possible after the nd documented by one tivities being reviewed nts. The QA REviewer		
3.2.8 g c s	ample Log Sheet - Log oncerning the activities ample and/or sampling e	book pages used to a associated with the classicated with the classicate	document information ollection of a specific		
3.2.9] a	ask Team Activity Log Sh ctivities associated with	e <u>et</u> -Logbookpagesuse ne sampling event.	ed to document general		
3.2.10 <u>v</u> t	Alidation of Field Analys The Quality Control (QC) of corrective actions were to acceptance criteria.	es -Validation and doc hecks meet acceptanc ken when data from	umentation of whether ce criteria and whether field analyses exceed		
4.0 RESPONSIE	ILITIES				
4.1 GROUE	GROUP MANAGER				
The Gr	oun Manager is responsi	le for approving this p	rocedure.		

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4.2	4.2 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) OFFICER					
	The QA/QC Officer is responsible for:					
	4.2.1 appr	4.2.1 approving this procedure and				
	4.2.2 verify	2.2 verifying that this procedure is implemented.				
4.3	HEALTH A	ND SAFETY (H&S) OFFI	CER			
	The H&S O contraceffed	The H&S Officer is responsible for ensuring that appropriate SAIC and contraceffect and verifying enforcement of same by line management.				
4.4	PROGRAM	OR PROJECT MANAGE	<u>ER</u>			
	The Program or Project Manager is responsible for:					
	4.4.1 desig proc	gnating a qualified persor edure;	n to train personnel	who will be using this		
	4.4.2 ensu	iring that all personnel are	e properly trained;			
	4.4.3 ensu	ensuring that this and all appropriate procedures are followed;				
	4.4.4 dete	rming what logbooks are	required:			
	4.4.5 verif Rec	ying that the appropriate tr ords Facility (CRF); and	aining records are si	ubmitted to the Central		
	4.4.6 verif this	ying that logbooks and log procedure.	book copies are sto	red in accordance with		
4.5	FIELD MAN	NAGER				
	The Field N	lanager is responsible for	r:			
	4.5.1 ensu with	uring that all personnel pe this procedure when it is	rform their assigned applicable:	duties in accordance		
	4.5.2 ensi	uring compliance with the	Sampling and Ana	lysis Plan (SAP);		

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	4.5.3 overall management of field activities;						
	4.5.4 ass	4.5.4 assisting in the preparation of the SAP and its implementation;					
	4.5.5 coordinating the actual content of field logbooks (e.g., the number and types of samples in each logbook, types of forms to include within the logbook, the need for blank forms, etc.);						
	4.5.6 as	signing field team members	to teams;				
	4.5.7 cod	prdinating and preparing for	field sampling activ	vities; and			
	4.5.8 sto	4.5.8 storing logbooks in accordance with this procedure.					
4.6	DOCUMENT CONTROL OFFICER (DCO)						
	The DCO is responsible for keeping the field logbook inventory in a "logbook of logbooks." The DCO records the serialized logbook number, the title or description of the logbook, the date of transfer, the name of the person to whom the logbook is assigned, and the specific project to which it is assigned. At the end of the sampling event, the DCO collects completed or unused field logbooks.						
4.7	FIELD SA	MPLING TEAM MEMBER	<u>IS</u>				
	The Field Sampling Team Members assist the Field Manager by collecting the required field samples and by documenting the sample collection activi- ties in a field logbook in accordance with this procedure.						
4.8	SITE HEA	LTH & SAFETY OFFICEF	(SHSO)				
	The SHSO is responsible for:						
	4.8.1 en po	suring that field activities (licies and procedures and	comply with SAIC	and contractual H&S			
	4.8.2 do	cumenting H&S activities in a	a field logbook accor	ding to this procedure.			

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	4.9		<u>/ER</u>	Lu <u>, , , , , , , , , , , , , , , , , , ,</u>	- <u>Lean</u>
		The QA rev legibility,con the completi	viewer is responsible for Isistency, and clarity of the on of the review process	verifying the acc field logbook entrie	uracy, completeness es and for documenting
5.0	GEN	NERAL INFO	RMATION		
	5.1	It is SAIC por to chemical, and Occupat and requiren	licy to maintain an effectiv radiological, and physica ion Safety and Health Adr nents.	ve program to conti stress which is cor ninistration (OSHA)	rol employee exposure nsistent with U. S. DOI established standard
	5.2	Any deviatio the Project documented	n from specified requiren Manager and/or the rele on the appropriate field	nents will be justifie evant Program Ma change forms.	d to and authorized by inager and should be
	5.3	Deviations f	rom requirements will the modified process.	e sufficiently doc	umented to allow re
	5.4	Refer to the	site- or project-specific H	&S Plan for releva	nt H&S requirements
	5.5	Refer to the	SAP for project/task-spec	cific sampling and a	analysis requirements
	5.6	SAIC and s documented or Project M 4.5.3.	ubcontractor personnel evidence of having beer anager for transmittal to	who use this pro trained on the pro the CRF in accord	ocedure must provide cedure to the Program dance with subsection
	5.7	Depending o recording fie to, Project, Fi Soil Boring, Inventory, ar the Samplin (QAPjP), the Manager def	on the requirements of the Id activities information. T eld Sampling, Existing We Measuring and Testing E and Health and Safety Logi g and Analysis Plan (SA Waste Management Pla termines which logbooks	project, various log hese logbooks incl Il Field, New Well Fi Equipment, Decont books. Based on in NP), the Quality As in, and H&S Plan, t are required.	books are prepared fo ude, but are not limited eld, Well Development amination, Usage and formation contained in ssurance Project Plan he Program or Project
	5.8	Field logboo factual, deta prejudices, c	k entries must be writter liled, and objective (i.e., printerpretations) and are	n clearly and legibl without distortion to be signed and d	y. All entries must be by personal feelings ated by the author an

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	a QA reviewer entries.	. Use only indelible, wat	erproof black ink wh	ien making logbook	
5.9	Field logbooks waterproof. Vo of each field lo	s must be bound and se erify or assign sequential ogbook page beginning v	equentially numbers page numbers to th vith the first page.	ed, and, if possible, e top outside corner	
5.10	Make a slash addition, write letter "S" and th	(/) through all zeros (0) to clearly so that the differe ne number one (1) and the	o distinguish them france between the nur eletters "I" or "I" will be	om the letter "O." In nber five (5) and the easy to distinguish.	
5.11	When recording the military or	ng the date and time, use 24-hour clock to record	e the format "mm/dd the time (e.g., 15:00	/yy" for the date and for 3:00 p.m.).	
5.12	When making corrections to field logbook entries, mark through the error with a single line. Do not obliterate the error. Initial and date the correction and, if possible, document the need for the change. Any error discovered in an accountable document will be corrected by the person who made the original entry.				
5.13	To prevent the of entry, fill in a sections of the through the ur entirely unuse corner of the used.	addition of information t all blanks or sections on field logbook pages are used areas. Do not remo d field logbook pages b page. Sign and date the	o logbook entries aft the field logbook pag not used, indicate su ove pages from the fi y drawing a diagona e page to indicate th	er their original date ges. If any blanks or uch by drawing a line eld logbook. Identify al line from corner to at the page was not	
5.14	Field logbook for keeping th to be recorded the title or de document is a assigned. All at the end of t	s must be controlled by a e field logbook inventory d includes, but is not limi escription of the logbook assigned, the date of tran field logbooks, completed the sampling event.	a project DCO. The r in a "logbook of log ted to, the serialized , the name of the p sfer, and the specific d or unused, must be	DCO is responsible books." Information document number, person to whom the project to which it is returned to the DCO	
5.15	5 Using indelibl cover of the f project name, organization, complete, the	e ink, contrasting the ba ield logbook includes, b client, site name, type(s) and project/contract num completion date is also	ckground color, info ut is not limited to, t of media sampled, r ber. In addition, the listed using indelible	mation listed on the he logbook number, name of the sampling start date and, when e ink.	

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5.16	A field logbo of any modifi Managemer modification or reference	ok is the primary record fo cations to the procedures it Plan, or the H&S Plai s and the dated signature of to document containing a	r field activities and i outlined in the SAP, n, along with the ju of the person authoriz authorizing signatur	ncludes a description the QAPjP, the Waste ustifications for such zing the modifications, res.		
5.17	Field logboo participants field personi	ks are intended to provide to reconstruct events tha nel if called upon to give t	sufficient data and o t occurred and to re estimony in legal pr	bservations to enable efresh the memory of oceedings.		
5.18	Field logboo or loss. Ma logbooks un the complete be made on	Field logbooks must be retrievable and protected against damage, deterioration, or loss. Maintain the security of field logbooks when not in use. Store field logbooks under lock and key or in a combination-locked safe. Photocopies of the completed field logbook pages are required to (dual storage requirements) be made on a regular basis and stored at a second location as backup records.				
5.19	Specific information to be reviewed during the QA review will include the following:					
	5.19.1 Completeness of field reports - to determine whether all requirements for activities in the SAP, the QAPjP, the Waste Management Plan, and the H&S Plan have been fulfilled; that complete records exist for each field activity; and that the procedures specified have been implemented. Any environmental data affected by incomplete records should be identified and documented.					
	5.19.2 identi	fication of valid samples;				
	5.19.3 corre	lation of field test data;				
	5.19.4 identi	fication of anomalous fiel	d test data; and			
	5.19.5 valida	ation of field analyses.				
6.0 <u>PRC</u>	DCEDURE					
6.1	SAMPLE LC	OG SHEET				
	6.1.1 The i each	Field Sampling Team Me field sample collected.	mber prepares a S	ample Log Sheet for		

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6.1.2	lf not Memi comp	using a preprinted Samp ber refers to the SAP or plete a Sample Log Sheet	ble Log Sheet, the F the QAPjP for infor	Field Sampling Team rmation necessary to		
6.1.3	lf usir alread	If using a preprinted Sample Log Sheet, the following information will already be filled in on the front side of the Sample Log Sheet:				
	 a) pro b) pro c) sa d) sa e) sa f) ge g) sa h) sa i) sa 	oject name; oject number; mple identification (ID) nu impling location code and ampling point code and de eographic location of sa asting); imple media code, along imple depth code, which s ample type.	umber; I description; escription; mple point, if ava with a description o shows the interval c	ilable (Northing and f the code; of collection; and		
6.1.4	The Field Sampling Team Member records the date (mm/dd/yy) and time (military or 24-hour clock) the sample is collected.					
6.1.5	The Field Sampling Team Member notes the collection method used and indicates the type of equipment used for the sample (e.g., bailer, auger, dipper).					
6.1.6	The F area (humic	ield Sampling Team Men e.g., temperature; comm d, snowing).	nber enters the wea ents such as sunny,	ther conditions in the cloudy, foggy, rainy,		
6.1.7	The Fi activit assist rigs, la	ield Sampling Team Mem ies in the area that could in the interpretation of th awn mowers).	ber indicates wheth have an effect on t e sample results (e	er there are any other he sample quality or .g., heavy traffic, drill		
6.1.8	lf appl obser outcrc	licable, the Field Samplin vations deemed unique t ops).	g Team Member re o the area (e.g., hig	cords any other field gh water, pools, rock		
6.1.9	The f measu inform	Field Sampling Team Nurements that are required nation:	Member performs dforthe sample, and	any field analytical records the following		

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a) th ra de b) th las	e measurement readings inges, record the highest etection limit, record the r e instrument serial number st calibration date.	s and units for eac value observed; for esult with the "<" pr and/or model numbe	h test performed (for r values less than the efix), and erandthe instrument's
6.1.10 The F indica	Field Sampling Team Me ate whether the sample w	mber checks the " as actually collecte	YES" or "NO" box to d.
6.1.11 The F indica	Field Sampling Team Me ate whether the SAP sam	mber checks the " pling procedure wa	YES" or "NO" box to is followed.
Note: This c speci	Note: Check "NO" only if the SAP sampling procedure was not followed. This does not include deviations from the H&S Plan. If "NO" is checked specify what deviations were necessary and why.		
6.1.12 The F the re	12 The Field Sampling Team Member signs his or her name and dates as the recorder of the sampling information.		
6.1.13 The F Samp Samp or the the S	Field Sampling Team Me ble Log Sheet. If not using ble Log Sheets, the Field S a QAPjP for information n ample Log Sheet.	mber completes th a preprinted Samp Sampling Team Men ecessary to comple	e second side of the le Log Sheet or blank nber refers to the SAP ete the second side of
6.1.14 If usir be fill	ng a preprinted field logbo ed in:	ook. the following in	formation will already
a) sa b) co c) co d) m e) pr f) na	ample ID number; ontainer volume; ontainer type; lethod name and analysis reservatives (type/volume ame of the laboratory to v	s number; e) required for the samples a	ample; and are being sent.
6.1.15 The F form	Field Sampling Team Mer number associated with	nber records the ch he sample.	ain-of-custody (COC)
6.1.16 If trar comm numb	nsportation of the sample non carrier, the Field Same per and name of carrier.	s to the laboratory i npling Team Memb	is to be provided by a per records the air bill

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	6.1.17 If a rinsate, field blank, and/or trip blank are associated with the samples, the Field Sampling Team Member records the ID numbers for the samples. If none of these are associated, he or she writes "N/A" in the spaces provided.					
	6.1.18 If a field duplicate sample was collected, the Field Sampling Team Member records the ID number for the sample. If no field duplicate sample was collected, he or she writes "N/A" in the space provided.					
	6.1.19 If i sit	necessary, the Field Sampl te.	ing Team Member	draws a sketch of the		
	6.1.20 The Field Sampling Team Member signs his or her name and dates as the recorder of the sampling information.					
	6.1.21 Tr ur ar	6.1.21 The Field Sampling Team Member draws a diagonal line across any unused portion of the page, or any unused Sample Log Sheets, signs, and dates.				
	Note: This may be done only after the Field Manager assures the recorder that the pages will not be used.					
	6.1.22 The Field Sampling Team Member submits the field logbook for a QA reviewer signs and dates the appropriate pages.					
	Ne pe	ote: Have the QA review prtaining to that specific sam	performed only what performed only what is a second to the second s	en all the log sheets		
6.2	TASK TE	EAM ACTIVITY LOG SHEE	<u>r</u>			
	6.2.1 Th St	he Field Sampling Team Me heet for each day's sampling	mber prepares a Ta g activities.	isk Team Activity Log		
	6.2.2 If re re Te	not using a preprinted field lo fers to the SAP or QAPjP for eam Activity Log Sheet.	gbook, the Field Sar information necessa	npling Team Member ary to complete a Task		
	6.2.3 If	using a preprinted logbook. Impleted on the Task Team	the following inform Activity Loa Sheet:	nation will already be		

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	a) pr b) pr	oject name and oject number.		
6.2.4	The f	Field Sampling Team Mei ling activity.	mber records the da	ate (mm/dd/yy) of the
6.2.5	The F Tearr	field Sampling Team Men Members involved in the	nber lists the names sampling project f	s of all Field Sampling or the date recorded.
6.2.6	The form form event limite	Field Sampling Team Me denoting start and stop ti . The information that st d to, the following:	mber records infor mes of activities rel hould be recorded v	mation in a narrative ating to the sampling will include, but is not
	 a) a final /li>	record of the times of same e site throughout the day ames, titles, and organiza- uring the day; ny unusual occurrences e coming and outgoing telep trivities (summary of comp age numbers of the Sample ask Team Activity Log Sh nes of and reasons for an otes describing problems to the sample of the sample of the sample of the sample of the sampling activity the sample of the sampling activity the sample of the sampling activity the sample the sampling activity the sample the sampling activity the sample	bling team arrivals to ations of any visitor ncountered during bhone calls that dire versation and time); e Log Sheets that co eet; ny project delays; with any of the equip nd relevant serial nu ch equipment was ple if performed; ar the Team Leader ivity.	and departures from rs who enter the site sampling; ctly relate to sampling mrespond to that day's oment or instruments, umbers; used to prepare the ad deems necessary to
6.2.7	The F and a	Field Sampling Team Mei Internoon weather condition	mber records a sun ons.	nmary of the morning
6.2.8	The F the re	Field Sampling Team Mer ecorder of the sampling in	nber signs his or he formation.	r name and dates as
6.2.9	The f dates Activi	Field Sampling Team Me any unused portions of ty Log Sheets.	mber draws a diag the sheet and any	onal line, signs, and unused Task Team

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	Note recor	: This may be done on der that the pages will no	ly after the Field N t be used.	Manager assures the	
6.2.	10 The f revie page	Field Sampling Team Me w and ensures that the res.	mber submits the f eviewer signs and (ield logbook for a QA dates the appropriate	
	Note perta	: Have the QA review ining to that specific sam	performed only wh ple are complete.	en all the log sheets	
6.3 <u>FIE</u>	LD LOG	BOOK TABLE OF CONT	ENTS		
6.3.	1 The I Conte	Field Sampling Team Me ents on a daily basis.	mber updates the	field logbook Table of	
	Note: The Table of Contents may be partially completed before the field activities.				
6.3.	6.3.2 If not using a preprinted field logbook, the Field Sampling Team Member refers to the SAP or QAPjP for information necessary to complete the field logbook Table of Contents.				
6.3.	3 If us provi	ing a preprinted field log ded on the field logbook	gbook, the followin Table of Contents p	g information will be bages:	
	a) pr b) pr	oject name and oject number.			
6.3.	4 The Well	Field Sampling Team Me ID number that was sam	mber records the S pled or installed.	ample ID or Borehole/	
6.3.	5 The drillir	Field Sampling Team M ng.	lember records the	e date of sampling or	
6.3.	.6 The Task Log	Field Sampling Team Me Team Activity Log Sheet Sheet page numbers.	mber records the sa and the Sample Log	ample's corresponding Sheet or Drilling/Core	
6.3	.7 The and Cont	Field Sampling Team Me dates any unused portic tents pages.	mber draws a diago n of the page and	onal line across, signs, any unused Table of	

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		Note: record	: This may be done or der that the pages will no	nly after the Field I of be used.	Manager assures th
	6.3.8	The F reviev pages	Field Sampling Team Me wand ensures that the QA s.	mber submits the f reviewer signs and	ield logbook for a Q I dates the appropriat
		Note: pertai	Have the QA review ining to that specific sam	performed only wh ple are complete.	en all the log shee
6.4		EVIEW	L		
	6.4.1	The (logbo the ge	DA reviewer ensures the ok entries using the proto eneral information given	accuracy and con cols for QA review g in Section 5.0.	npleteness of the fiel iven in Section 3.2 an
	6.4.2	The C requi	A reviewer ensures that red in Section 6.0, Steps	the Sample Log Sh 6.1.1 through 6.1.2	eets are completed a 22.
		Note a QA	: Both the front and back review and signature.	k pages of the Sam	ple Log Sheet requi
	6.4.3	The (comp	DA reviewer ensures that leted as required in Sect	t the Task Team A tion 6.2. Steps 6.2.	ctivity Log Sheets a 1 through 6.2.10.
		Note corre	: A Task Team Activity sponds to each Sample	Log Sheet entry m Log Sheet in the fie	ust be completed th eld logbook.
	6.4.4	The (upda Steps	QA reviewer ensures the ted with the appropriate s 6.3.1 through 6.3.8.	at the field logbook information as rea	Table of Contents quired in Section 6.
	6.4.5	The (revie omiss have	DA reviewer provides his w of the field logbook p sions, inconsistencies, ille been appropriately resol	or her signature and ages has been pe gible entries, ambigi ved by the Field Sai	I date only after the C rformed and all note uities, and inaccuracion mpling Team Membe
		Note	: The QA reviewer will n	ot make any additio	onal entries to the fie

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7.0	 a) additions to the Table of Contents: b) numbering of the pages at the top outside corners; c) labeling of the front field logbook cover; and d) drawing the diagonal line across. signing, and dating any blank Task Team Activity Log Sheets, Sample Log Sheets, and Table of Contents pages that were not assigned a sample ID number. This may be done only after the Field Sampling Team Members and the Field Manager assure the QA Reviewer that the pages will not be used. 7.0 <u>RECORDS</u> Documentation generated as a result of this procedure is collected and maintained in accordance with requirements specified in QAAP 17.1, Records Management. For projects in an on hold status: pagiely completed legispacks are considered temporary. 				
	records and are m not to exceed thre logbook is closed completed logboo	aintained in a locked, one ee months from date of las out and submitted in acc ok will be submitted to the	hour fire rated safe of st entry in logbooks. cordance with QAAF e client Project Mana	After that period, the 17.1. A copy of the ager.	
8.0	ATTACHMENTS				
	8.1 Attachment	I - Example Logbook Cov	ver Page		
	8.2 Attachment	II - Example Table of Con	ntents Page		
	8.3 Attachment	III - Example Task Team	Activity Log Sheet		
	8.4 Attachment	IV - Example Drilling/Cor	e Log Form		
	8.5 Attachment	V - Example Sample Me	dia Codes		
	8.6 Attachment	VI - Example Sample Log	g Sheet		
	8.7 Attachment	VII - Example Monitoring	Well Form		
	8.8 Attachment	VIII - Example Telescope	ed Well Form		
	8.9 Attachment	IX - Example Well Install	ation Activity/Progre	ess Report Form	
	8.10 Attachment	X - Example Well Develo	opment Form		

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8.11 Attachment Water-Leve	8.11 Attachment XI - Example Hydrogeologic and Geologic Characterization Field Water-Level Measurements Form					
8.12 Attachment	XII - Example Borehole o	r Well Plugging/Ab	andonment Form			
8.13 Attachment	XIII - Example Decontam	ination Form				
8.14 Attachment	XIV - Example Equipmen	t Calibration Form				
8.15 Attachment	XV - Example Record of	Data Entry Form				
8.16 Attachment	XVI - Example Sample IE)/COC Tracking Fo	rm			

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		Attachme Example Logbook	nt I Cover Page				
		LOG BO	OK .				
	PROJEC	T TITLE:					
	WORK SITE:						
		· · ·					
	CONTRACT #:						
	TASK ORDER:						
	PROJECT MANAGER:						
	TELEPHO	NE NUMBERS:					
	SITE LOCATION:						
	START DATE:						
		END DATE:	<u></u>				

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Attachment II Example Table of Contents Page

GE	FIELD LOG	PAGE	FIELD LOG
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	Attachme	nt III	
	Example Task Team A	ctivity Log Sheet	
PROJ	TASK TEAM ACTIV	TTY LOG SHEET PROJECT NO:	
Date cause Task Tex	udd/yy):	PA	GE OF
	······································		
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				Exam	ple Drilli	ng/C	ore Lo	og Form	
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	Site L	ocation;						Drilline(date/tin	ae)
	Boria	/ Well I	D:		•		-	Started/	
	Depth	Drilled		feet			Co	Hole Diameter	
	Depth	to Water	·	feet				Hammer Weigh	t inches
	Drillia Drillia	ng Metho ng Fluid I	d Used		-			Hammer Drop	inches
		•			Drilling C				
	Logge	d By				Dri	lier		
	Comp	20y			Drill Mak	Hel A M	per		
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SAIC FI TECHNI PROCE	ELD CAL DURE	<u>.</u>		Proce	dure No. FP-1215	.:	F	evision:	Page: 21 of 35
				A1 Exan	tachmer nple Drill	nt IV (ing/C	contir ore L	nued) og Form	
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	PES	PARED	BY:	-				DATE:	

SAIC FIELD TECHNICAL	Procedure No.:	Revision:	Page:
PROCEDURE	FTP-1215	0	22 of 35
	Attachme Example Sample	ent V Media Codes	
2	OLID MATRICES	LIQUID MAT	RICES
SOIL [01] Sur [02] Sut [09] Oth	lace (0-6 inches) surlace (>6 inches) er	SURFACE WATER [51] Lake/Pond [52] River/Stream [53] Impoundment/Pond [54] Discourdment/Pond	
SEDIMENT/S (11) Lak (12) Rim (13) Imp (13) Imp (14) Day	LUDGES e/Pond e//Stream cundment/Pond m/Tank	[55] Sonny Seep [59] Other GROUNDWATER	
(19) OH AIR SAMPLE [21] Filt [27] Sec	er r	[61] Abandoned Well [62] Extraction Well [63] Injection Well [64] Imigation Well [65] Lysimeter [66] Monitoring Well	
[22] Swe [23] Swe [24] Gas [23] Oth	ant epings/Fugitive Dust es er	67) Observation Well 68) Piezometer 69) Other 64) Public Water Suppl 68) Purge Well 68] Purge Well	y .
BIOLOGICAL/ [31] Biot [39] Oth	TERRESTRIAL a m	(60) Vapor Well (66) Leachaie Well	
GEO-TECHNIC [41] Ret [42] Ret [43] Pas [43] Oth	CAL lined on #40 uned on #200 led through #200 #	CONTAINERIZED SEALED [71] Drum/Tank [79] Other	UNSEALED [81] Drum/Tank [89] Other
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TECHNICAL	Procedure No		VI51011.	, ugo,
PROCEDURE	FTP-1215		0	23 of 35
	Attaci Example Sa	hment VI mple Log S	heet	
PROJECT NAME	SAMPI	ELOG SHEET	PROJE	NALY ACT NO:
SAMPLE ID NUME	BER:	DATE CO	LIECTED (ARVI	
SAMPLING LOCA DESCRIPTION: _	TTON CODE:			TIME:
SAMPLING POINT DESCRIPTION: _	Г CODE:			
NORTHING:	EASTING	:	ELEVATIO	N:
SAMPLE DEPTH	CODE: : :		BELOW	LAND SURFACE
FIELD OBSERVA	TIONS:			
FIELD OBSERVA	TIONS:			
FIELD OBSERVA	TIONS:	UMITS	SERIAL NO.	LAST CALIR.
FIELD OBSERVA	MENTS READING	UNITS	SERIAL NO.	LAST CALLER
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		SA	MPLE LOG SHEET					}	PROCEDUR	TECHNICAL
SAMPLE ID	NUMBER:					· · · ·	<u>ራራ ም</u> . 	{	m	
	CONTAINER TYPE	METHOD NAME AND NUMBER ANALYSIS	PRESERVATIVES (TYPE/VOL)	C-O-C /	AIR BILL /	CONTADVER LOT /	LABORATORY			
								Attachment VI (c Example Sample	FTP-1215	Procedure No.:
					· · · · · · · · · · · · · · · · · · ·			ontinued) Log Sheet	0	Hevision:
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Attachment IX Example Well Installation Activity/Progress Report Form

WELL	. INST	ALLATION	ACTIVITY / PRO	GRESS REPORT	
ROJECT NAME:			2 2	PROJE	CT NO:
VELL ID:		······································	Date Started:	Time:	
			Finished:	Time	
Drilling Method:			Borehole Diam	eter:	
Supervisor/Geologist:			Driller:		
Drilling Company:			Helper:		
Footage drilled / Auger	red / C	lared:	_ ft to f	1	
MATERIAL USED:	Bent	onite:	Bags	Bentonite:	Buckets
	Cem	ent(grout):	Bags		
	Sand	l:	Bags	Comments:	
Water Used:		Source:		Quantity:	Gals
Lubricants Used:		*******			
Well Construction Ma	terials	Used:			
Inch Well	Casin	د ۱		Inch Well S	Screes ft
Inch Oute	er Casi	ng	n		•
Well Caps & Plug	۰ <u>ــــــ</u>	pair	Nur	ober of Guard Post	us t
Drain Hole (yes/po)		Sta	mped ID (yes/00)	
Activities / Comments	:				
		-			

			•		
Driffers Signature:			· · ·		Date:
Supervisory Geologi	st Sign	nature:			Date:
					Date
Pield Supervisor Sig	matur				Date.

TECHNICAL	Procedure No.:	Revision:	Page:
PROCEDURE	FTP-1215	0	28 of 35
	Attachme Example Well Devel	nt X opment Form	
PROJECT NAME	Well Develop	TENT FORM	TT NO:
Date://		······································	Time:
Well Number and	Location:		
Development Crew	:		
			·····
Driller(if applicable):			
	·	<u> </u>	
Water Levels/Time	:: Initial:/	Pumping:/_	
	Final:/		
Total Well Depth:	Final:/ Initial:FT B1	OC Final:	FT BTOC
Total Well Depth: Date and Time:	Final:/ Initial:FT B7 Begin:/	OC Final: Completed:	FT BTOC
Total Well Depth: Date and Time: Development Meth	Finai:/ Initiai:FT BT Begin:/ nod(S):	OC Final: Completed:	FT BTOC
Total Well Depth: Date and Time: Development Meth Total Quantity of	Final:/ Initial:FT B1 Begin:/ mod(S): Water Removed:	OC Final: Completed:	FT BTOC
Total Well Depth: Date and Time: Development Meth Total Quantity of	Final:/ Initial:FT B1 Begin:/ mod(S): Water Removed:S	OC Final: Completed:	FT BTOC /
Total Well Depth: Date and Time: Development Meth Total Quantity of	Final: /	OC Final: Completed: aks	FT BTOC
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Total Well Depth: Date and Time: Development Meth Total Quantity of FIELD MEASU Temperat Specific Cond pH	Final: /	Completed:	FT BTOC
Total Well Depth: Date and Time: Development Meth Total Quantity of FIELD MEASU Temperat Specific Cond pH	Final:	Completed:	FT BTOC
Total Well Depth: Date and Time: Development Meth Total Quantity of FIELD MEASU Temperat Specific Cond pH Turbidi	Final: /	OC Final: Completed: als BER DATE OF LA	FT BTOC
Total Well Depth: Date and Time: Development Meth Total Quantity of FIELD MEASU Temperat Specific Cond pH Turbidi	Final:	Completed:	FT BTOC

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Procedure No.: Revision: Page: FTP-1215 0 29 of 35 Attachment X (continued) Example Well Development Form		123	TEM	L DEVELOP	ILAT FORM	(conf) 'j'	BCT NOI	[]	CAL
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Procedure No.: Revision: Page: FTP-1215 0 29 of 35 Attachment X (continued) Cample Well Development Form	TILATCE 28-AMB TREADT	104	ę	ITECITIC COMPUCTIVITY LABIOLONG	ert Andre Untreg		REMARKS PICLUDING AND PICOUCTION	Ex	
Jure No.: Revision: Page: -1215 0 29 of 35			╎					Atta ample	FTP
No.: Revision: Page: 15 0 29 of 35 ment X (continued) ell Development Form								chn e W	-121
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ASUREMENTS	10N:	-	RECORDED BY																			
D WATER-LEVEL MR	WELL ELEVAT		REMARKS																			
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IARACTERIZA			INSTRUMENT																			
	CATION:		WATER ELEVATION (MSL)																			
GIC AND C	2		DEFTH TO WATER (BTC)																			
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	WELL	METI	DATE																			

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SAIC FIELD	Procedure No.:	Revision:	Page:
TECHNICAL PROCEDURE	FTP-1215	0	31 of 35
Example	Attachme Borehole or Well Plu	nt XII gging/Abandonmei	nt Form
B PROJECT NAME	OREHOLE OR WELL PLUG	GING / ABANDONMENT	ECT NO:
SITE ID NUMBER	;	DATE PLUGGED	//
SITE COORDINAT	TES: N: E:	DEPTH BLS (n)
TYPE OF CASING	i:		
CASING DIAMET	ER (ID) (is.)	GROUND ELEVATION	(ft msi)
SCREENED ELEV	ATION (ft msi)		
GEOLOGIC MAT	ERIAL AT SCREEN		
APPROX. VOLUN PLUGGING MET	ME OF PLUGGING MATERI	AL (cu ft.)	
REMARKS			
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SAIC FIELD	Procedure No.:	Revision:	Page:
TECHNICAL PROCEDURE	FTP-1215	0	32 of 35
	Attachme Example Decontar	nt XIII mination Form	
PROJECT NAM	DECONTAMIN	ATION	ect no:
DATE RDS	APMENT SATE NO.	пемя	DECONED BY
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1		-{		ECT NO:	PROJ				<u></u>		ROJECT N/
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			DATE	NAME	RESPONSE	BACKGROUND	POST	ADJUSTMENT	PRE		DENTIFIER
		1	DATE			CREUN					DENTIFIER
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SAIC FIELD TECHNICAL	Procedure No.:	Revision:	Page:					
PROCEDURE	FTP-1215	0	34 of 35					
	Attachmer Example Record of D	nt XV Jata Entry Form						
	FOR DATA COORDINATOR USE ONLY							
DATA EN	TRY PERFORMED BY:							
DATE EN	NTERED:							
NOTES:								
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DATE F	NTERED:							
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DATA	ENTRY PERFORMED BY:							
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PROCEDURE	F	TP-1215	(35 of 35		
E	ample Samp	Attachmer ble ID/Chain-of-	nt XVI •Custody T	racking Fo	orm		
	SAI	MPLE ID / COC TR	ACKING FORI				
PROJECT NAME				PRC	JECT NO:		
SAMPLE ID	FIELD COC	LAB COC	SAMPLE ID	FIELD COC	LAB COC		
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SCIENCE APPLICATIONS INTERNATIONAL CORPORATION FIELD TECHNICAL PROCEDURE

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Title: Field Measurement Procedures: pH, Temperature, Salinity, and Conductivity

Procedure No: FTP-880	Revision: 3	Date: 10/13/93 Pa	age 1 of 5
Group Manager:	Date :	QA/QC Officer: James C. Bronne	Date:

1.0 PURPOSE

The purpose of this procedure is to establish guidelines for the uniform calibration and use of pH, temperature, salinity, and conductivity meters.

2.0 <u>SCOPE</u>

This procedure applies to all pH, temperature, salinity and conductivity meters. It is not necessary that one instrument be capable of measuring all four parameters (i.e. pH, temperature, salinity, and conductivity).

3.0 REFERENCES, RELATED READING, AND DEFINITIONS

3.1 <u>REFERENCES</u>

- 3.1.1 Environmental Surveillance Procedures Quality Control Program, Environmental and Safety Activities, Martin Marietta Energy Systems, Inc. January 31, 1990, Procedure ESP-300-1.
- 3.1.2 Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual, U.S. Environmental Protection Agency, Region IV Environmental Services Division, Georgia, February 1, 1991.
- 3.1.3 Science Applications International Corporation Environmental Project Management Manual (SAIC EPMM).
- 3.1.4 Science Applications International Corporation Quality Assurance Ádministrative Procedures (SAIC QAAPs).

SAIC FIELD		Procedure No.:	Revision:	Page:
PROCED		FTP-880	3	2 of 5
3.2	2 <u>DEFINI</u>	TIONS		
	3.2.1	Buffer Solution - Commercially of Concentrations. Solutions number or similar documenta	y prepared standard are traceable to the tion.	solutions with known e manufacturer by lot
4.0 <u>R</u>	ESPONSIE	BILITIES		
4.	1 <u>GROU</u>	P MANAGER		
	The Gro	up Manager is responsible fo	r approving this pro	cedure.
4.:	2 <u>QUALI</u>	TY ASSURANCE/QUALITY	CONTROL (QA/QC)	OFFICER
	The QA	VQC Officer is responsible fo	r:	
	4.2.1	approving this procedure and		
	4.2.2 v	erifying that this procedure is	being implemented	
4.	3 <u>HEALT</u>	H AND SAFETY (H&S) OFF	CER	
	The H& H&S po line ma	S Officer is responsible for ens blicies and procedures are in e magement.	uring that appropriate ffect and verifying er	e SAIC and contractual nforcement of same by
4.	4 PROGE	AM OR PROJECT MANAGI	<u>=R</u>	
	The Pr	ogram or Project Manager is	responsible for:	
	4.4.1	designating a qualified pers procedure;	son to train person	nel that will use this
	4.4.2	ensuring that all personnel a	re properly trained;	
	4.4.3	ensuring that this and all app	propriate procedures	are followed; and
	4.4.4	verifying that the appropriate Records Facility (CRF).	raining records are s	ubmitted to the Central

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SAIC FIELD	Procedure No.:	Revision:	Page:
PROCEDURE	FTP-880	3	3 of 5
4.5 <u>FIELD MAN</u>	AGER		· ·
The Field M	anager is responsible for	:	
4.5.1 ensu with	ring that all personnel per this procedure when it is a	form their assigned applicable;	duties in accordance
4.5.2 ensu	ring compliance with the	Sampling and Analy	ysis Plan (SAP); and
4.5.3 over	all management of field a	ctivities.	
5.0 <u>GENERAL</u>			
5.1 It is SAIC po to chemical, Departmen Administrati	olicy to maintain an effectiv radiological, and physica at of Energy (DOE) at on (OSHA) established s	ve program to contro al stress which is co nd Occupational standards and requi	bl employee exposure nsistent with the U.S. Safety and Health rements.
5.2 Any deviation the Project documented	on from specified requiren Manager and/or the rele d on the appropriate field	nents will be justified evant Program Mar change forms.	to and authorized by nager and should be
5.3 Deviations creation of t	from requirements will the modified process.	be sufficiently docu	imented to allow re-
5.4 Refer to the	e site- or project-specific H	1&S Plan for releva	nt H&S requirements.
5.5 Refer to the	SAP for project/task-spe	cific sampling and a	nalysis requirements.
5.6 SAIC and documented or Project M	subcontractor personnel d evidence of having beer lanager for transmittal to	who use this proc trained on the proc the CRF.	cedure must provide cedure to the Program
5.7 The manufa are attached	acturer's operating instruct d to this procedure for ea	ctions accompaniec ch instrument on sit	l by a summary page e.
5.8 pH measu electrometri potential, or	rements (Hydronium ically using either a glass a combination electrode	Ion Concentration electrode in combinand pH meter.	on) are determined nation with a reference

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SAIC	SAIC FIELD		Procedure No.:	Revision:	Page:
PROC		RE	FTP-880	3	4 of 5
	5.9	Conductivity electrode or	r measurement is determi conductivity cell.	ned electrometrical	y using either a glass
6.0	PRO	CEDURE			
	6.1	Choose an i	nstrument that is consiste	ent with investigativ	e requirements.
	6.2	See the mainstrument a which instru calibration if	anufacturer's operating i as per manufacturer's in ment is being used. Also more than one choice ex	nstructions prior to structions and note o note in the field lo kists.	o use. Operate the in the field logbook ogbook the method of
	6.3	Check the instrument to	last calibration date to o the calibration lab if the	determine if it is calibration is out of	current. Return the date.
	6.4	Record mea	surements in the approp	riate field logbook.	
7.0	REC	ORDS			
	Docu in ac	umentation g cordance wit	enerated as a result of th h requirements specified	is procedure is colle in QAAP 17.1, Rec	ected and maintained ords Management.
8.0	ATT	ACHMENTS			
	8.1	Attachm	ent I - Field Checklist		
	8.2	Attachmo are attac	ent II - A summary sheet an ched for each project requ	dthemanufacturer's uirement.	operating instructions
		** *			

SAIC FIELD	Procedure No.:	Revision:	Page:	
PROCEDURE	FTP-880	3	5 of 5	
	Attachmen Field Check	t I dist		
Appropriate	pH, Temperature, Salini	ty, and Conductivit	y Instruments	
Calibration S	Standard/check source			
Safety Glass	ses or Monogoggies*			
Gioves*				
Safety Shoe	95*			
Logbook				
Black Indelit	ole Pen			
Sampling ar	nd Analysis Plan			
Health and S	Safety Plan			
Manufacture Manual	er's Instrument Calibratio	n and Maintenanc	9	
Decontamin	ation Equipment			
*When specifie	d by the site-specific H&	S plan.		

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SCIENCE APPLICATIONS INTERNATIONAL CORPORATION FIELD TECHNICAL PROCEDURE Title: Field Measurement Procedures: Dissolved Oxygen Date: 6/30/93 Page 1 of 6 Procedure No: FTP-955 Revision: 0 Date: QA/QC Officer: Date: Group Manager: 19/92 1.0 PURPOSE The purpose of this procedure is to provide general instructions both for calibrating dissolved oxygen meters and for taking field measurements of dissolved oxygen in natural and waste waters. 2.0 SCOPE This procedure describes the use of the membrane electrodes (ME) probe method for field measurement of dissolved oxygen in a variety of ground, surface, and saline waters, as well as in domestic and industrial wastes. 3.0 REFERENCES, RELATED READING, AND DEFINITIONS 3.1 REFERENCES 3.1.1 Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual, U.S. Environmental Protection Agency, Region IV Environmental Services Division, Georgia, February 1, 1991. 3.1.2 Science Applications International Corporation Quality Assurance Administrative Procedures (SAIC QAAPs) 3.1.3 Science Applications International Corporation Quality Assurance Program Plan (SAIC QAPP). 3.1.4 Science Applications International Corporation Environmental Project Management Manual (SAIC EPMM). 3.1.5 Science Applications International Corporation Field Technical Procedure (SAIC FTP) 400, Equipment Decontamination.

SAIC FIELD TECHNICAL PROCEDURE		Procedure No.: FTP-955	Revision: 0	Page: 2 of 6		
3.1.6	3.1.6 Science Applications International Corporation Field Technical Procedure (SAIC FTP) 625, Chain-of-Custody.					
3.1.7	Scier (SAI	nce Applications Internatio C FTP) 1215, Use of Field	nal Corporation Field d Logbooks.	d Technical Procedure		
3.2 <u>DEF</u>	NITIO	NS				
None) .					
4.0 <u>RESPONS</u>	SIBILIT	IES				
4.1 <u>SAIC</u>	COR	PORATE OFFICER IN C	HARGE			
The Meas	SAIC C sureme	Corporate Officer in Chargent Procedures: Dissolve	ge is responsible for d Oxygen.	oversight of Field		
4.2 <u>GRC</u>	UP M	ANAGER				
The	Group	Manager is responsible f	or approving this pr	ocedure.		
4.3 <u>QUA</u>		SSURANCE/QUALITY	CONTROL (QA/QC) OFFICER		
The	QA/QC	Officer is responsible fo	r:			
4.3.1	appi	oving this procedure and				
4.3.2	verif	ying that this procedure is	s being implemente	d.		
4.4 <u>HEA</u>	<u>LTH A</u>	ND SAFETY (H&S) OFF	ICER			
The H&S line	H&SO policie manag	fficeris responsible for ens is and procedures are in e ement.	uring that appropriat ffect and verifying e	e SAIC and contractual nforcement of same by		
4.5 <u>PRC</u>	GRAN	OR PROJECT MANAG	ER			
The	Progra	um or Project Manager is	responsible for:			
4.5.	1 ens	uring that all personnel a	re properly trained;			

SAIC FIELD	Procedure No.:	Revision:	Page:		
PROCEDURE	FTP-955	0	3 of 6		
4.5.2	ensuring that this and all app	propriate procedures	are followed; and		
4.5.3	verifying that the appropriate Records Facility (CRF).	raining records are su	ubmitted to the Central		
4.6 FIELD	MANAGER				
The Fig	eld Manager is responsible fo	or:			
4.6.1	ensuring that all personnel p with this procedure when it is	erform their assigned s applicable;	duties in accordance		
4.6.2	ensuring compliance with th	e Sampling and Anal	ysis Plan (SAP); and		
4.6.3	overall management of field	activities.			
5.0 <u>GENERAL</u>					
5.1 It is SA to che Depart (OSHA	It is SAIC policy to maintain an effective program to control employee exposure to chemical, radiological, and physical stress which is consistent with U.S. Department of Energy (DOE) and Occupational Safety and Health Administration (OSHA) established standards and requirements.				
5.2 Any de the Pro	eviations from specified requinois of the relevant of the rele	rements will be justifie evant Program Mana	ed to and authorized by ger.		
5.3 Deviat creatic	Deviations from requirements will be sufficiently documented to allow re- creation of the modified process.				
5.4 Refer	ier to the site- or project-specific H&S Plan for relevant H&S requirements.				
5.5 Refer	er to the SAP for project/task-specific sampling and analysis requirements.				
5.5 SAIC docum or Pro 4.5.3.	SAIC and subcontractor personnel who use this procedure must provide documented evidence of having been trained on the procedure to the Program or Project manager for transmittal to the CRF in accordance with subsection 4.5.3.				

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SAIC FIEL	.D	Procedure No.:	Revision:	Page:			
TECHNICA PROCEDU	AL IRE	RE FTP-955 0 4 of 6					
5.6	The most co in water are membrane the current	The most common ME instruments for determination of dissolved oxygen (DO) in water are dependent upon the rate of diffusion of molecular oxygen across a membrane and upon electrochemical reactions. Under steady-state conditions, the current or potential can be correlated with DO concentration.					
5.7	Interfacial d and a signi performanc	ynamics at the ME-sampl ficant degree of interfacia e, turbulance must be cor	e interface are a fac I turbulence is nect nstant.	tor in probe response essary. For precision			
5.8	Dissolved of probes. Ho DO probes. example, c eventually of under certa	Dissolved organic materials are not known to interfere in the output from DO probes. However, dissolved inorganic salts are a factor in the performance of DO probes. Reactive gases that pass through the ME probes may interfere. For example, chlorine will depolarize the cathode, cause a high probe output, and eventually desensitize the probe. Hydrogen sulfide will interfere with ME probes under certain conditions.					
5.9	Dissolved compensat	oxygen ME probes are ion is normally provided b	temperature sensit by the manufacturer	ive, and temperature			
5.1	0 Refer to the for calibrati	e manufacturer's instruction ng and operating each sp	ons, which are attac becific DO meter.	hed to the equipment,			
6.0 <u>PR</u>	OCEDURE						
6.1	CALIBRAT	CALIBRATION PROCEDURES					
	6.1.1 The and inst	exact calibration method model of the DO meter beir ruction manual for the calib	used is dependent used is dependent used. Referto the pration method applice	upon the specific make specific manufacturer's cable to the instrument.			
	6.1.2 Fou limi sati	6.1.2 Four common types of calibration methods used include, but are not limited to the following: Winkler method, air calibration method, 100% air saturated water method, and the salt water method.					
6.2	FIELD MEASUREMENT PROCEDURE						
	6.2.1 Ins hol me	pect membrane before ea es. If the membrane is d mbrane soaked in distilled	ch field trip for air be efective, it must be d water before calib	ubbles, oily film, and/or replaced and the new ration.			
	6.2.2 Fol	low manufacturer's instru	ctions for sample m	easurement.			

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SAIC FIELD TECHNICAL	Procedure No.:		Revision:	Page:			
PROCEDURE	FTP-955		0	6 01 6			
Attachment I Field Checklist							
DO Meter with S	DO Meter with Stirrer Reagents						
Biochemical Ox Bottles (300 ml)	ygen Demand _		WM Flasks (500	ml minimum size)			
Burets with Hold	ders _		Siphon Tube				
Safety Glasses	or Monogoggles _		Gloves				
Safety Shoes	. –		Container				
Custody Seals,	as required		Chain-of-Custody	Forms, as required			
Logbook	_		Black Indelible P	en			
Sampling and A	nalysis Plan						
Manufacturer's	Instrument Calibrati	ion a	nd Maintenance M	lanual			
Health and Safe	ety Plan						
Decontaminatio	n Equipment						
Lab Wipes							
Appropriate Co	ntainers for Waste						
Spatulas							

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SCIENCE APPLICATIONS INTERNATIONAL CORPORATION FIELD TECHNICAL PROCEDURE

Title: Groundwater Sampling Procedures: Water Level Measurement

Procedure No: FTP-370	Revision: 0	Date: 6/30/93	Page 1 of 8
Group Manager:	Date : 6/29/93	OA/OC Officer:	Date: m 6/29/93

1.0 PURPOSE

The purpose of this procedure is to describe methods used to obtain water level measurements in completed wells or piezometers, and to specify limitations of the respective methods.

2.0 <u>SCOPE</u>

This procedure gives overall technical guidance for obtaining piezometric head measurements in wells through the use of conducting probe and a weighted steel or fiberglass tape.

3.0 REFERENCES. RELATED READING, AND DEFINITIONS

- 3.1 <u>REFERENCES</u>
 - 3.1.1 Installation Restoration Program Standard Operating Procedures, Hazardous Waste Remediation Actions Program, Martin Marietta Energy Systems, Inc., October 1991, Procedure FP7-2.
 - 3.1.2 Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual, U.S. Environmental Protection Agency, Region IV Environmental Services Division, Georgia, February 1, 1991.
 - 3.1.3 Science Applications International Corporation Quality Assurance Administrative Procedures (SAIC QAAPs).
 - 3.1.4 Science Applications International Corporation Quality Assurance Program Plan (SAIC QAPP).
 - 3.1.5 Science Applications International Corporation Environmental Project Management Manual (SAIC EPMM).

SAIC FIELD TECHNICAL	Procedure No.:	Revision:	Page:			
PROCEDURE	F1P-370	0	2010			
3.1.6 S	3.1.6 Science Applications International Corporation Field Technical Procedure (SAIC FTP) 1215, Use of Field Logbooks.					
3.1.7 S	cience Applications Internatio SAIC FTP) 400, Equipment [nal Corporation Field Decontamination.	d Technical Procedure			
3.2 DEFINI	<u>FIONS</u>					
Piezom	etric head - The height to wh	ich water will rise in	a cased well.			
4.0 RESPONSIB	ILITIES					
4.1 <u>SAIC C</u>	ORPORATE OFFICER IN C	HARGE				
The SAI Samplir	CCorporateOfficer in Charge Ig Procedures: Water Level	is responsible for ove Measurement.	ersight of Groundwater			
4.2 <u>GROUF</u>	MANAGER					
The Gro	oup Manager is responsible t	or approving this pr	ocedure.			
4.3 <u>QUALI</u>	Y ASSURANCE/QUALITY	CONTROL (QA/QC) OFFICER			
The QA	/QC Officer is responsible fo	r:				
4.3.1	approving this procedure and	ł				
4.3.2	verifying that this procedure	s being implemente	d.			
4.4 HEALT	H AND SAFETY (H&S) OFF	ICER				
The H& H&S po manage	S Officer is responsible for en licies and procedures are in efferment.	suring that appropriat ect and verifying enfo	te SAIC and contractual preement of same by line			
4.5 <u>PROG</u>	RAM OR PROJECT MANAG	SER				
The Pr	ogram or Project Manager is	responsible for:				
4.5.1	ensuring that all personnel a	re properly trained;				

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SAIC FIELD	Procedure No.:	Revision:	Page:	
PROCEDURE	FTP-370	0	3 of 8	
4.5.2 en	suring that this and all appr	opriate procedures	are followed; and	
4.5.3 ver Ce	ifying that the appropriate ntral Records Facility (CRF	e training records a	are submitted to the	
4.6 <u>FIELD MA</u>	NAGER			
The Field	Manager is responsible for	:		
4.6.1 en:	suring compliance with the	Sampling and Analy	ysis Plan (SAP);	
4.6.2 en wit	suring that all personnel per h this procedure when it is	form their assigned applicable; and	duties in accordance	
4.6.3 ove	all management of field a	ctivities.		
5.0 <u>GENERAL</u>				
5.1 It is SAIC to chemic Departme Administra	It is SAIC policy to maintain an effective program to control employee exposure to chemical, radiological, and physical stress which is consistent with U.S. Department of Energy (DOE) and Occupational Safety and Health Administration (OSHA) established standards and requirements.			
5.2 Any devia by the Pro	tions from specified require ject Manager and/or the re	ements will be justif levant Program Ma	ied to and authorized nager.	
5.3 Deviations creation o	from requirements will the modified process.	be sufficiently docu	mented to allow re-	
5.4 Refer to the	e site- or project-specific +	1&S Plan for relevar	nt H&S requirements.	
5.5 Refer to th	e SAP for project/task-spe	cific sampling and a	nalysis requirements.	
5.6 SAIC and document or Project 4.5.3.	subcontractor personnel ed evidence of having been Manager for transmittal to	who use this pro- n trained on the proc the CRF in accord	cedure must provide edure to the Program ance with subsection	
5.7 Initial mor using a pl	nitoring of the well headsp noton ionization detector (f	pace and breathing PID), flame ionizatio	zone concentrations in detector (FID), and	

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SAIC FIELD TECHNICAL PROCEDURE		Procedure No.:	Revision:	Page:
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	combustible required leve	gas meters will be evaluels of protection.	uated by the H & S	Officer to determine
5.8	All groundw recorded in t	ater level measurements the field logbook or grour	are made to the n ndwater sampling fo	earest 0.01 foot, and orm.
5.9	In measuring point of know point on the	g groundwater levels, the wn altitude, which is norr upper edge of the inner v	re will be a clearly- nally identified by a well casing.	established reference a painted mark at one
5.10	The recorde	d field notes must clearly	describe the refere	ence used.
5.11	After a moni groundwate recorded. T	itoring or groundwater ob r level has stabilized, the The date and time of the r	servation well has t initial depth to the w eading is recorded.	peen installed and the vater is measured and
5.12	Information	related to precipitation is	included in the data	а.
5.13	The total de	pth of the well is measur	ed and recorded, if	possible.
5.14	Cascading of sounding	water within a borehole c devices. If this conditior	an cause false read is observed, it is n	dings with some types oted in the logbook.
5.15	Oil layers m the conditio	nay cause problems in de n exists, it is noted in the	etermining the true v logbook.	water level in a well; if
5.16	Water level	readings are taken regul	arly, as required by	the Field Manager.
5.17	All water lev map must b	vel measurements at a since made in the shortest ti	te used to develop a me practical.	a groundwater contour
5.18	Groundwate	er with dilute ionic content les of the electronic wate	may not conduct er r level indicator to a	nough current between activate the instrument.
5.19	Measuring The weight	tapes usually have a lim will be stainless steel or	it of about 100 fee an inert material sp	t and a weighted end. ecified by the SAP.
5.20) Sampling to prior to sa specified in	ools and equipment are mpling and decontamin FTP-400, Equipment De	protected from sou ated prior to and econtamination.	urces of contamination between sampling as

SAIC FIEL			Procedure No.:	Revision:	Page:
PROCEDURE			FTP-370	0	5 of 8
6.0 PROCEDURE					
6.1	PREP	ARAT	ION		
	6.1.1	Don o and/o well.	clean gloves, check the we or Rad meters. Unlock ar	ell with organic vapo nd open the well; no	ranalyzer (OVA), PID, te the condition of the
	6.1.2	Recc inform	nd sampling station num nation, as is applicable.	iber, date, time, an	d any other pertinent
6.2	WATE	RLE	VEL MEASUREMENTS		
	Locate	e refei	ence mark at top of the i	nner well casing.	
	6.2.1	lf ref innei	erence mark is not prese well casing.	ent, make one on ti	ne highest side of the
	6.2.2	Make suita casir	e a scratch on the outsid ble instrument, being cat ng.	de edge of the wel reful that cuttings d	I casing with a file or o not fall into the well
	6.2.3	lf ref	erence mark is not prese	nt, alert Field Mana	ger.
6.3	ELEC	TRO	NIC WATER-LEVEL IND	ICATOR	
	Collec	t wat	er level measurements w	ith electronic water	level indicator.
	6.3.1	6.3.1 Check battery on decontaminated electronic water-level indicator and on alarm.			
	6.3.2	Lower an electronic water-level-indicator probe into the well, making sure that the cord or the probe does not scrape the sides of the we casing.			
	6.3.3	Whe the	en the alarm sounds and probe.	/or the red light illu	minates, stop lowering
	6.3.4	Puli	up the probe until alarm	no longer sounds.	

SAIC FIELD	Procedure No.:	Revision:	Page:
PROCEDURE	FTP-370	0	6 of 8
6.3.5 Li th	ower probe again slowly. Sto le light illuminates and remain	op at the instant the ns illuminated.	alarm sounds and/o
6.3.6 H	old cord to side of casing wh	ere reference mar	c is etched.
6.3.7 N	lark cord with thumb where it	touches reference	mark.
6.3.8 U in to	se a measuring device to crement to marked point on p of inner casing to the wate	determine distant cord. The total dep r level.	ce from last marke th is the distance from
6.3.9 R Io	ecord measurement to with gbook.	in 0.01 feet as De	epth to Water in fie
6.3.10 R N	epeat steps 6.3.2 through 6. leasurement should remain c	3.10, two to three to constant.	times for consistenc
6.3.11 P	ull electronic water-level indi	cator from well and	decontaminate.
6.3.12 C	lose and lock the well cap.		
6.4 <u>STEEL (</u>	OR FIBERGLASS TAPE		
Collect w	vater level measurements wit	h steel or fiberglas	s tape.
6.4.1 lr a	spect decontaminated tap prrection required for missing	be and determine tape.	any measureme
6.4.2 C	halk one or two feet of tape;	lower measuring ta	ape through well.
6.4.3 L m g o m	isten for the sound of the t leasuring point on top of the roundwater or the depth belo r the stick-up of the mark a lust be known or measured, a	ape hitting the wa well. To determin ow the surface, the bove the ground and subtracted or ac	ter. Note reading a le the elevation of the elevation of the main surface (respectively ided as is appropriate
6.4.4 R	emove tape from well and n	ote wet cut on tape	
6.4.5 S	ubtract wet cut from measurir within 0.01 foot in field loob	ng point reading and ook.	d record measureme

SAIC FIELD		Procedure No.:	Revision:	Page:		
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6.4.6	Repe const	Repeat steps 6.4.2 through 6.4.5 above. Measurement should remain constant within 0.01 foot.				
6.4.7	Pull tape from well and decontaminate as specified in FTP-400, Equipment Decontamination.					
6.4.8	Close and lock well cap.					
6.4.9	Record information in field logbook in accordance with FTP-1215, Use of Field Logbooks.					
7.0 <u>RECORDS</u>						
Documenta in accordan	Documentation generated as a result of this procedure is collected and maintained in accordance with requirements specified in QAAP 17.1, Records Management.					
8.0 ATTACHME	ENTS					
8.1 Attach	ment	I - Field Checklist				

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SAIC FIELD	Procedure No.:	Revision:	Page:		
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Attachment I Field Checklist					
Ele	ctronic Water-Level Indicator	(Conducting Probe)			
Ste	el or Fiberglass Tape Measur	e with Raised Marki	ngs		
Ke	ys to Unlock Wells				
Log	jbook				
Bla	ck Indelible Pen				
Ap	Appropriate Containers for Waste and Equipment				
Gio	Gloves				
Sat	Safety Shoes				
Sat	Safety Glasses or Monogoggles				
He	Health and Safety Plan				
De	Decontamination Equipment (As specified in FTP-400)				
Sa	mpling and Analysis Plan				
Pla	stic Sheeting				
Ma	Manufacturer's Calibration and Instrument Manual				
Мо	Monitoring Equipment (PID, OVA, and Rad Meters)				

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SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Title: Groundwater Sampling Procedures: Using a Bailer

2.3

Procedure No: FIP-600	Revision: U	Date: 6/30/93	-age 1010
Group Manager:	Date :	DA/QC Officer:	Date:
	(29/93	James C. Brown	m 6/29/93

1.0 PURPOSE

The purpose of this procedure is to describe the standard method for collecting groundwater samples using a bailer.

2.0 <u>SCOPE</u>

This procedure applies to collection of groundwater samples used to obtain physical, chemical, or radiological data.

3.0 REFERENCES, RELATED READING, AND DEFINITIONS

3.1 <u>REFERENCES</u>

- 3.1.1 Environmental Surveillance Procedures Quality Control Program, Environmental and Safety Activities, Martin Marietta Energy Systems, Inc., January 31,1990, Procedure ESP-302-3.
- 3.1.2 Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual, U.S. Environmental Protection Agency, Region IV Environmental Services Division, Georgia, February 1, 1991.
- 3.1.3 Science Applications International Corporation Quality Assurance Administrative Procedures (SAIC QAAPs).
- 3.1.4 Science Applications International Corporation Quality Assurance Program Plan (SAIC QAPP).
- 3.1.5 Science Applications International Corporation Environmental Project Management Manual (SAIC EPMM).
- 3.1.6 Science Applications International Corporation Field Technical Procedure (SAIC FTP) 1215, Use of Field Logbooks.

SAIC FIELD	Procedure No.:	Revision:	Page:
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3.1.7 Sci (SA	ence Applications Internatio IC FTP) 400, Equipment D	nal Corporation Field Decontamination.	d Technical Procedure
3.1.8 Sci (SA	ence Applications Internatio IC FTP) 650, Packaging a	nal Corporation Field nd Shipping of Field	d Technical Procedure d Samples.
3.1.9 Sci (SA	ence Applications Internatio IC FTP) 625, Chain-of-Cu	nal Corporation Fiek stody.	d Technical Procedure
3.2 DEFINITION	<u>DNS</u>		
None.			
4.0 <u>RESPONSIBIL</u>	TIES		
4.1 SAIC COP	PORATE OFFICER IN C	HARGE	
The SAIC water San	Corporate Officer in Charg ppling Procedures: Using a	ge is responsible for a Bailer.	oversight of Ground-
4.2 <u>GROUP N</u>	1ANAGER		
The Grou	Manager is responsible f	or approving this pr	ocedure.
4.3 <u>QUALITY</u>	ASSURANCE/QUALITY	CONTROL (QA/QC) OFFICER
The QA/C	C Officer is responsible fo	r:	
4.3.1 ap	proving this procedure and		
4.3.2 ve	ifying that this procedure is	s being implemente	d.
4.4 <u>HEALTH</u>	& SAFETY (H&S) OFFICE	<u>:R</u>	
The H&S H&S polic line mana	Officeris responsible for ens ies and procedures are in e gement.	uring that appropriat ffect and verifying e	e SAIC and contractual nforcement of same by

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SAIC FIEL	D	Procedure No.:	Revision:	Page:
PROCEDL	AL JRE	FTP-600	0	3 of 8
4.5	PROGRAM	OR PROJECT MANAGE	R	
	The Progra	m or Project Manager is r	esponsible for:	
	4.5.1 ensu	iring that all personnel are	e properly trained;	
	4.5.2 ensi	uring that this and all appr	opriate procedures	are followed; and
	4.5.3 verif Cen	ying that the appropriate tral Records Facility (CRF	e training records a	are submitted to the
4.6	FIELD MAI	NAGER		
	The Field N	lanager is responsible for	:	
	4.6.1 ens with	uring that all personnel pe this procedure when it is	rform their assigned applicable;	I duties in accordance
	4.6.2 ens	uring compliance with the	Sampling and Anal	ysis Plan (SAP); and
	4.6.3 ove	rall management of field a	ctivities.	
5.0 <u>GE</u>	NERAL			
5.1	It is SAIC p to chemica Departme Administra	olicy to maintain an effecti al, radiological, and phys nt of Energy (DOE) a tion (OSHA) established s	ve program to contr ical stress which is and Occupational standards and requi	ol employee exposure consistent with U.S. Safety and Health rements.
5.2	Any deviat	ions from specified requir ect Manager and/or the re	ements will be justi elevant Program Ma	fied to and authorized anager.
5.3	B Deviations creation of	from the requirements w the modified process.	ill be sufficiently do	cumented to allow re-
5.4	Refer to th	e site- or project-specific	H&S Plan for releva	nt H&S requirements.
5.5	5 Refer to th	e SAP for project/task-spe	ecific sampling and a	analysis requirements.

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SAIC TEC	C FIELD HNICAL	Procedure No.:	Revision:	Page:
PRO	CEDURE	FTP-600	0	4 of 8
	5.6 SAIC and s documented or Project Ma with subsect	subcontractor personnel l evidence of having been anager for transmittal to the tion 4.5.3.	who use this proc trained on the proc le Central Records I	edure must provid edure to the Program acility in accordanc
	5.7 Bailers will b The SAP typ	e constructed of stainless bically specifies appropria	steel or Teflon and v te size of bailer.	vill be bottom loading
	5.8 The cord will polyethylene be reused or	ll be compatible with ana e). Materials are typically s decontaminated, but ma	lytes (i.e., stainless specified in the SAP. by be dedicated.	steel, Teflon, nyloi Braided cord will n
	5.9 Only bottom bailers with b and sample	loading stainless steel of ottom emptying devices i agitation. See Attachmer	r Teflon bailers will I s highly recommend nt II.	be used. The use of the to reduce spillag
	5.10 Wells will ha	ve dedicated bailers to m	inimize cross-conta	mination.
	5.11 Only unused	, decontaminated, or dec	licated cord will be u	used.
	5.12 A reel for wir	nding the cord is useful in	raising and lowerin	g the bailer.
	5.13 Refer to a sit be reviewed	e-specific H&S Plan for on by the Field Manager prices	detailed H&S proced or to beginning work	dures. This plan wi
6.0	PROCEDURE			
	6.1 Don appropri	ate personal protective e	quipment prior to a	ny field activities.
	6.2 Place plastic from coming	sheeting around base of w in contact with contamina	vell and in work area t ated surfaces.	o prevent equipmen
	6.3 Unlock and r	emove the well cap, note	condition of well.	
	6.4 Prior to samp meters, and/c sample I.D., c information (i	ling, check the well with p or other appropriate instru- late, time, weather condition. .e., water level, presence	hoton ionization dete ments. Record samp ons, and any other we of product).	ector (PID), radiatior bling station number ell-specific, pertinen
	6.5 Remove dec from well cas reach bottom	ontaminated bailer from ing, attach cord if necess of well.	protective covering ary, allowing enoug	or dedicated baile h length for bailer to

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SAIC FIELD		Procedure No.:	Revision:	Page:
PROCEDURE		FTP-600	0	5 of 8
6.6 Sele ther to b	ect appro m ready f e collecte	priate sample bottle, add or use. Lower bailer slow ed.	d preservatives, if n ly to the interval from	ecessary, and place n which the sample is
6.7 Allo aera	w bailert ation.	o fill with a minimum of su	rface disturbance to	prevent sample water
6.8 Rais plas	se bailer stic sheel	to surface, feeding cord ing. Do not allow bailer	into container, ree cord to contact grou	l, or place onto clean und.
6.9 Rer	move the	cap from the sample bo	ttle, and tilt the bott	e slightly.
6.10 Pou of th	ur the sar he sampl	nple slowly down the ins le.	ide of the sample b	ottle. Avoid splashing
6.11 Lea orga	ave adeqi anic anal	uate air space in the bottle lysis (VOA) flasks which	e to allow for expans are filled with no air	sion, except for volatile present and capped.
6.12 Lab to b	bel the bo be sure it	ttle carefully, and clearly. is legible.	Enterallinformation	accurately, and check
6.13 Sar app pre and	mples are propriate, paration f d Shippin	e placed in containers de packed in ice as soon orshipmentare implemen g of Field Samples.	fined according to r as possible. Pac ted in accordance wi	needs, and then, when kaging, labeling, and thFTP-650, Packaging
6.14 Cor FTI	mplete fie P-1215, I	ld logbookand chain-of-a Use of Field Logbooks a	ustody forms in accor nd FTP-625, Chain	dance with procedures -of-Custody.
6.15 Re	place bai	iler if dedicated; replace	well cap and lock.	
6.16 Sar cor 400	mpling to ntaminati 0, Equipr	ools, instruments, and e on prior to use and deco nent Decontamination.	quipment are prote Intaminated after us	ected from sources of se as specified in FTP-
7.0 <u>RECOR</u>	DS			
Docume accorda	entation g Ince with	enerated as a result of th requirements specified i	is procedure is colle n QAAP 17.1, Rec	ected and maintained in ords Management.

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			<u> </u>	

8.0 ATTACHMENTS

- 8.1 Attachment I Field Checklist
- 8.2 Attachment II Typical Bottom Loading Bailer

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	Attachr Field Ch	nent I ecklist	
Bailer		Labels and 1	ags
Container, R Sheeting to (eel or Plastic Collect Cord	Sampling an	d Analysis Plan
Cord*		Health and S	Safety Plan
Logbook		Waste Mana	gement Plan
Sample Con	tainers with Lids	Decontamina	ation Equipment
Safety Glass	ses or Monogoggies	Lab Wipes	
Safety Shoe	es, if required	Appropriate Waste and E	Containers for Equipment
Ice/Cooler, a	is required	Monitoring E	quipment
Custody Sea	als, as required	Preservative	S
Plastic Shee	ting	Litmus Pape	r
Pipettes		Sampling Fo	orms
Bucket of Kn	iown Volume	Keys for We	ll Lock
Black Indelib	le Pen		
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*Refer to SAP for Approved Material

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SCIENCE APPLICATIONS INTERNATIONAL CORPORATION FIELD TECHNICAL PROCEDURE

Title: Equipment Decontamination

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Group Manager:	Date :	QA/QC Officer:	Date:
- Aneer C	Free en a hard	16 C. A. Couras	8/27/96

1.0 PURPOSE

The purpose of this procedure is to describe decontamination methods and related issues involving the physical removal of chemical and radioactive contaminants from equipment.

2.0 <u>SCOPE</u>

This procedure applies only to the decontamination of equipment used in field investigations which may be associated with sample activities, but which do not directly contact the samples. Sample collection devices, which directly contact the samples, are addressed in Procedure FTP-405, "Cleaning and Decontaminating Sample Containers and Sampling Equipment."

This procedure on Equipment Decontamination includes the following:

- a) field test equipment (e.g., flowmeters);
- b) equipment to which sample devices may be attached (e.g., drill rig, drill rod);
- c) well drilling equipment:
- d) miscellaneous field support equipment which may be subjected to incidental exposure to contaminants; and
- e) shipping containers.

This procedure does not include the following:

- a) chemical analysis equipment, such as the portable gas chromatograph;
- b) health and safety equipment;
- c) protective clothing; and
- d) sample containers and sample collection devices.

3.0 REFERENCES, RELATED READING, AND DEFINITIONS

- 3.1 <u>REFERENCES</u>
 - 3.1.1 Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual, U.S. Environmental Protection Agency, Region IV Environmental Services Division, Georgia, February 1, 1991.

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3.1.2 S A	ience Applications Interna Iministrative Procedures (SA	ational Corporation	Quality Assurance
3.1.3 S P	ience Applications Interna ogram Plan (SAIC QAPP).	ational Corporation	Quality Assurance
3.1.4 Se (S Se	ience Applications Internation AIC FTP) 405, Cleaning and Impling Equipment.	nal Corporation. Field Decontaminating S	d Technical Procedure Sample Container and
3.2 DEFINIT	<u>ONS</u>		
3.2.1 <u>D</u> de m lir Sj	ionized Water - Tap Water ionizing resin column. The o stals or other inorganic compo- nits) as defined by a stand pectrophotometer scan.	treated by passing deionized water sho bunds (i.e., at or above ard Inductively Cor	y through a standard buld contain no heavy ve analytical detection upled Argon Plasma
3.2.2 <u>Er</u> "s di	uipment - Those items (variant) ampling equipment") necess ectly contact the samples.	iously referred to as sary for sampling ac	s "field equipment" or ctivities, which do not
3.2.3 <u>La</u> de	<u>boratory Detergent</u> - A stan tergent, such as Liquinox, o	dard brand of phos r the equivalent.	phate-free laboratory
3.2.4 Q de st ar a gi st	ganic-free Water - Tap wa ionizing units or water from a ould not contain pesticides, he d less than 50 ug/l of purgea ow-level GC/MS scan. Org ass or Teflon containers an ainless steel containers.	ater treated with a Milli-Q system (or ec erbicides, extractable able organic compou anic free water sho d dispensed from c	ctivated carbon and quivalent). This water e organic compounds, unds as measured by ould be stored only in only glass, Teflon, or
3.2.5 <u>S</u>	mpling Devices - Utensils lection and processing that	and other impleme directly contact acti	nts used for sample Jai samples.
3.2.6 <u>Se</u> de be de	Ivent - Pesticide grade isop contamination in most instai justified and approved by cumented in the field logbor	ropanol is the stand nces. The use of an the responsible pr oks.	dard solvent used for ny other solvent must roject personnel and

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Θ	SAIC FIEL TECHNICA PROCEDU	D AL JRE	Procedure No.: FTP-400	Revision: 0	Page: 3 of 19
		3.2.7 <u>Tar</u> syst	Water - This refers to w tem.	ater from a tested a	and approved, water
	4.0 <u>RE</u>	SPONSIBILI	TIES		
-	4.1	<u>GROUP M</u>	ANAGER		
		The Group	Manager is responsible fo	or:	
		4.1.1 app	proving this procedure: and		
		4.1.2 app	proving site specific release	e criteria for radiatio	n decontamination.
	4.2	QUALITY	ASSURANCE/QUALITY C	ONTROL OFFICE	B
			C Officer is responsible for		
		4.2.1 app	proving this procedure: and		
		4.2.2 ver	ifying that this procedure is	being implemente	d.
	4.3	<u>HEALTH /</u>	AND SAFETY OFFICER		
		The H&S (tractual H& managem	Officer is responsible for er &S policies and procedures ent.	nsuring that approp s are in effect and v	riate SAIC and con- erifying same by line
	4.4	PROGRA	M OR PROJECT MANAG	ER	
		The Progr	am or Project Manager is I	responsible for:	
		4.4.1 des pro	signating a qualified person cedure;	n to train personnel	who will be using this
		4.4.2 en	suring that all personnel ar	e properly trained;	
		4.4.3 en:	suring that this and all app	ropriate procedures	are followed;
		4.4.4 vei Re	rifying that the appropriate to cords Facility (CRF); and	raining records are s	ubmitted to the Central

SAIC FI TECHN PROCE	ELD ICAL DURE	Procedure No.: FTP-400	Revision: 0	Page: 4 of 19
	4.4.5 ensur to be	ringthat the program/proje performed safely.	ct has adequate an	d appropriate resources
4	1.5 <u>FIELD MAN</u>	AGER		
	The Field Ma	anager is responsible for	:	
	4.5.1 ensu with t	ring that all personnel per his procedure when it is a	form their assigne applicable;	d duties in accordance
	4.5.2 ensu	ring compliance with the	Sampling and Ana	alysis Plan (SAP);
	4.5.3 overa	all management of field a	ctivities:	
	4.5.4 selec and r	ting the decontamination n egulatory requirements:	nethod in conforma and	nce with SAP guidelines
	4.5.5 ensu	ring that equipment deco	intamination is per	formed safely.
5.0 <u>(</u>	GENERAL			
ł	5.1 It is SAIC p exposure to the requiren established Defense) re	policy to maintain an eff chemical, radiological, ar nents of Occupational Sa standards and requirements quirements apply on a pr	ective program for nd physical stress afety and Health ents. Clients spec roject specific basi	or control of employee which is consistent with Administration (OSHA) ific (e.g. Department of s.
	5.2 Any deviatio Project Mar documented	ons from specified requirer nager and/or the relevand on the appropriate field	ments will be justifie Int Program Man change forms.	ed and authorized by the ager, and should be
	5.3 Deviations creation of t	from requirements will the modified process.	be sufficiently do	cumented to allow re-
	5.4 As a minimu worn while of coat, or spla potential ad coated Tyve high temper power to ar area	um, safety glasses or gog decontaminating equipme ash apron will be worn if ji lverse effects. Faceshie ek or equivalent coveralls rature water. Ground fau ny portable electrical equi	gles, and nitrile or e ent. Uncoated Tyv ustified by contami Id, heavy duty PV s will be worn while It circuit interrupted ipment in the equi	equivalent gloves will be rek coveralls, laboratory inant concentration and C or equivalent gloves cleaning with steam o rs will be used to supply oment decontamination

PROCEDURE5.5Remo5.6SA5.6SAdoor5.7Pracor5.8Co5.8Co5.9PaA1by5.10Dodearsusu	efer to the s ethods and AIC and s ocumented Project Ma rocedures ctivities will octamination econtamination at are not elicate surfa	FTP-400 site-, or project-, or task-s d schedules required. ubcontractor personnel evidence of having been anager for transmittal to for packaging and disp be described in the proje licable document. on control (e.g., use of able coatings) may be us easily decontaminated (aces.	0 specific SAP for partic l who use this pro- n trained on the pro- the CRF. Dosal of all waste g ict-specific SAP, Was f plastic wrappings, sed for delicate instr (e.g. porous or oddly	5 of 19 cular decontamination cedure must provide edure to the Program enerated during field ste Management Plan use of strippable or uments and materials y shaped materials or
 5.5 Rem 5.6 SA do or 5.7 Pr ac or 5.8 Co de that de 5.9 Pa At by 5.10 Do de ar su 	efer to the s ethods and AIC and s ocumented Project Ma rocedures ctivities will ocedures ctivities will other app ontamination econtamination at are not elicate surfa	ite-, or project-, or task-s d schedules required. ubcontractor personnel evidence of having been anager for transmittal to for packaging and disp be described in the proje licable document. on control (e.g., use of able coatings) may be us easily decontaminated (aces.	specific SAP for partic I who use this pro- n trained on the pro- the CRF. Dosal of all waste g ect-specific SAP, Was f plastic wrappings, sed for delicate instr (e.g. porous or oddly	cular decontamination cedure must provide edure to the Program enerated during field ste Management Plan use of strippable or uments and materials y shaped materials or
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5.7 Pr ac or 5.8 Co de that de 5.9 Pa A1 by 5.10 Do de ar su	rocedures ctivities will other app ontaminatio econtamina at are not elicate surf aint or any fter remova	for packaging and disp be described in the proje licable document. on control (e.g., use of able coatings) may be us easily decontaminated (aces.	oosal of all waste g ect-specific SAP, Wa f plastic wrappings, sed for delicate instr (e.g. porous or oddly	enerated during field ste Management Plan use of strippable or uments and materials y shaped materials or
5.8 Co de tha de 5.9 Pa At by 5.10 Do de ar su	ontaminatio econtamina at are not elicate surf aint or any fter remova	on control (e.g., use of able coatings) may be us easily decontaminated (aces. other coatings must be re	f plastic wrappings, sed for delicate instr (e.g. porous or oddly	use of strippable or uments and materials y shaped materials or
5.9 Pa At by 5.10 Da de ar su	aint or any fter remova	other coatings must be re		
5.10 De de ar su	y the appro	al of such coating(s), the priate method.	emoved from downh equipment must the	ole drilling equipment. In be decontaminated
	econtamir econtamina rea mustal urface cont	nation of equipment s ation area, removed fror so be in a location free of aminants.	should be perform n any sampling loca direct exposure to air	ed in a designated tion. This designated borne and radiological
5.11 De ac	econtamin ctivities.	ated field equipment sho	uld be stored upwind	of all decontamination
5.12 TI cc ur m de w	he objecti ontaminat ncontamina ninimize pe econtamina vaste.	ves of decontaminatio ed surfaces; to minin ated surfaces; to avoid a rsonnel exposures. The ation while minimizing th	n are: to remove mize the spread iny cross-contaminat intent is to accompli- he generation of add	contamination from of contamination to tion of samples; and to sh the required level of ditional solid and liquid
5.13 R na	lequired de		s and apparatus are	e dependent upon the

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5.14 For any o	of the specific decontamir	nation methods that	at may be used, the

substitution of higher grade water is permitted. (e.g. the use of organic-free water in place of deionized water). However, it must be noted that deionized water and organic-free water are less effective than tap water in rinsing away the detergent film during the initial rinse.

- 5.15 When appropriate, it may be required that decontaminated equipment be surveyed, inspected, and tagged by designated personnel.
- 5.16 Contaminated or dirty equipment will not be stored with clean equipment.
- 5.17 Documentation of all decontamination activities is to be recorded in the field logbook.

6.0 PROCEDURES

6.1 <u>GUIDELINES FOR SELECTING SPECIFIC DECONTAMINATION</u> <u>SCHEDULES AND PROCEDURES</u>

- Note: The following is intended only as a general guideline for understanding the relevant concerns pertaining to equipment decontamination. The actual selection of all decontamination methods and schedules must be based on requirements within the site- or project-specific SAP and the discretion of the Field Manager.
- 6.1.1 Each decontamination task must be individually assessed based on characteristics of equipment to be cleaned:
 - a) equipment surfaces and materials:
 - b) size of equipment;
 - c) fragility of equipment; and
 - d) equipment use.
- 6.1.2 Assessment should also be based on the characteristics of the media to be removed by decontamination: oily sludge, heavy clay, etc.
- 6.1.3 Assessment must take into account potential contaminants of concern (e.g., radioactive versus chemical contaminants), levels of contamination, and related Health and Safety issues.

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- 6.1.4 The Field Manager selects the method deemed most appropriate for a particular task. If results are unsatisfactory, proceed step-by-step in selecting a more extensive method, as required, to successfully complete the decontamination. Deviation from plan will be documented in an appropriate field logbook and by a field change process appropriate to the project.
- 6.1.5 If the item has not been successfully decontaminated or cannot be monitored due to its shape (such as the inside of a pipe), a decision as to further decontamination measures is made by the Field Manager.
- 6.1.6 As a general guideline for selecting decontamination schedules and procedures, it is helpful to discriminate among three categories of field equipment. These three categories of equipment can be distinguished by the degree to which they may come into contact with contaminated media and their potential to indirectly affect sample integrity. Consequently, each of these three categories will usually require different consideration in terms of decontamination schedules and methods used:
 - a) The first category includes equipment that should not contact the sample, should not affect sample integrity, and need not contact the contaminated media. The need to decontaminate this equipment can generally be avoided by keeping it away from incidental contact with contaminated media (e.g., placing equipment on clean plastic drop cloths). Following incidental contamination of this equipment, it would require decontamination in order to minimize the spread of contamination off-site and to minimize personnel exposures, and not out of concern for sample integrity.

Examples of equipment within this category include: ambient air thermometers and certain other air monitoring instruments, emergency equipment, and other miscellaneous field support equipment.

b) The second category includes equipment that will contact the contaminated media, but need not contact the sample, nor affect sample integrity. This equipment would require decontamination in order to minimize the spread of contaminants to uncontaminated surfaces and to minimize personnel exposures, not out of concern for sample integrity. This category of equipment generally is decontaminated between sample locations and decontaminated or packaged before being removed from the site.

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An example can be found in the use of flowmeters used in conjunction with surface water sampling. For ongoing use in the field, when moving from sample location to sample location, the flowmeter would generally require only a tap water rinse. This would be acceptable, since use of the flowmeter downstream from each sample location would remove any chance of cross-contaminating samples. When finished using this equipment, the flowmeter would then require more extensive decontamination prior to transporting it off-site.

c) The third category includes equipment that may have an impact on sample integrity due to its' function in close proximity to the sample before and during sample collection. This type of equipment generally requires more extensive decontamination procedures and usually requires decontamination to be scheduled prior to arriving on-site, between each sample location, and more often if deemed necessary to prevent cross-contamination (e.g., when drilling or digging through a contaminated area into an uncontaminated area).

Examples of this category of equipment can be found in the use of a drill rig, drill rods and auger flights used in drilling the borehole to sample depth prior to soil sample collection.

- 6.1.7 Other factors influencing selection of decontamination procedures and schedules include:
 - a) Consideration must be given to the effect of various decontamination solutions on the material(s) of which the equipment is composed (see Attachment I). Before selecting a cleaning method for specific field test equipment/instrumentation. consult the manufacturer's instructions in order to avoid the possibility of damage to instrument components.
 - b) For the first two basic categories of equipment (described in 6.1.6 a & 6.1.6 b), a distinction should be made between requirements for decontamination in the field between sample locations and the requirements prior to storage off-site. For the first two categories of equipment, in most instances, there will be a need for more extensive decontamination procedures before equipment is stored off-site.

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6.2 CHEMICAL DECONTAMINATION

Equipment and materials that come into contact with known or suspected chemical contaminants are considered chemically contaminated. The item is released for unrestricted use if, after decontamination, it is free of visible contamination. If organic contamination is a concern, the equipment should be scanned with appropriate instruments (e.g., PID or FID) before release off-site.

6.3 RADIOACTIVE DECONTAMINATION

- 6.3.1 The method for decontamination of equipment, tools, and materials is based on the material contaminated (e.g., mud, grease), the radiation levels, and the specific radionuclides to be removed.
- 6.3.2 Criteria for releasing decontaminated equipment for unrestricted use is contained in site specific criteria. Which can be found in the Sampling and Analysis Plan. See Attachment II for an example of standard criteria for release of equipment exposed to surface radioactive contamination.
- 6.3.3 Porous materials (e.g., aged wood, hollow concrete block, rubberized coatings, etc.), and equipment and materials which have surfaces inaccessible to the surveyor (e.g., electric motors, small diameter pipes, etc.), and items with surface coatings that could bind or cover the contamination (e.g., mud. grease, strip-coat paints, etc.) cannot be released for unrestricted use. These materials are considered on a case-by-case basis and released on authorization from the field H&S Officer or authorized designee.

6.4 MISCELLANEOUS EQUIPMENT DECONTAMINATION PROCEDURES

- 6.4.1 Well Sounders or Tapes Used to Measure Ground Water Levels
 - a) Wash with laboratory detergent and tap water.
 - b) Rinse with tap water.
 - c) Rinse with deionized water.
 - d) Allow to air dry overnight. (doesn't apply to field cleaning)
 - e) Wrap equipment in aluminum foil with the shiny side of the foil facing outward (with tab for easy removal), seal in plastic, and date.

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6.4.2	Submersible Pumps and Hoses Used to Purge Ground Water Wells			
	a) Pu flu	a) Pump a sufficient amount of soapy water through the hose to flush out any residual purce water		
	 b) Using a brush, scrub the exterior of the contaminated hose and pump with soapy water. Rinse the soap from the outside of the hose with tap water. Next rinse the hose with deionized water and recoil onto the spool. 			
	c) Pi	 C) Pump a sufficient amount of tap water through the hose to flush out soapy water 		
	d) Pr	 J) Pump a sufficient amount of deionized water through the hose to flush out the tap water, then purce with the pump in reverse mode. 		
	e) Ri (a	 Rinse the outside of the pump nousing and hose with deionized water (approximately 1/4 gal.) 		
	f) Ec pc En	Equipment will be placed in a polyethylene bag or wrapped with polyethylene film to prevent contamination during storage or transit. Ensure that a set of rotors, fuses, and cables are attached to each cleaned pump.		
	The same procedure applies whether this equipment is cleaned in the field equipment warehouse or in the field.			
6.4.3	Porta	ble Power Augers such a	as the Little Beaver	
	a) Th sta ha re Th b) Al ou	ne engine and power head eam jenny, or hand wash ave to be laboratory dete move oil, grease, and hy nese units should be rinse I auger flights and bits s utlined in 6.4.7.	d should be cleaned ed with a brush using rgent but should no draulic fluid from the ed thoroughly with t hall be cleaned util	with a power washer, g detergent (does not bt be a degreaser) to e exterior of the unit. ap water. izing the procedures
6.4.4	Misce	ellaneous Flow Measuring	g Equipment	
	a) Be	efore being stored, misce washed with laboratory a thorough deionized w	llaneous flow meas detergent, rinsed wi ater rinse.	uring equipment shall th tap water, followed
	c) W	rap equipment in aluminu	um foil with the shiny	v side facing outward.

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6.4.5 ISCO Flow Meters. Field Analytical Equipment, and Other Field Instrumentation

The exterior of sealed, watertight equipment such as ISCO flow meters should be washed with a mild detergent (for example, liquid dishwashing detergent) and rinsed with tap water before storage. The interior of such equipment may be wiped with a damp cloth if necessary. For ongoing use in the field, flow measuring equipment such as weirs, staff gages and velocity meters may be cleaned with tap water after use between measuring locations, if necessary.

Other field instrumentation should be wiped with a clean, damp cloth. pH meter probes, conductivity probes. DO meter probes, etc., should be rinsed with deionized water before storage. Before selecting a cleaning method for specific field instruments, consult the manufacturer's instructions in order to avoid the possibility of damage to instrument components.

The desiccant in flow meters and other equipment should be checked and replaced if necessary each time the equipment is cleaned.

6.4.6 Ice Chests and Shipping Containers

All ice chests and reusable containers shall be washed with laboratory detergent (interior and exterior), rinsed with tap water and air dried before storage. In the event that an ice chest becomes severely contaminated, in the opinion of the field investigator, with concentrated waste or other toxic material, it shall be cleaned as thoroughly as possible, rendered unusable, and properly disposed.

- 6.4.7 Large Soil Boring and Drilling Rigs and Associated Equipment
 - a) All drilling rigs, drilling equipment, backhoes, and all other associated equipment involved in the drilling activities (auger flights and bits) shall be cleaned and decontaminated before entering the designated drill site.
 - b) The drill rig and/or other equipment associated with the drilling and sampling activities shall be inspected to insure that all oil, grease, hydraulic fluid, etc., has been removed, that all seals and gaskets are intact and that there are no fluid leaks.
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ar or mast, backhoe bucket
bindles, cathead, etc.) sh
efore being brought on th
aterial which may have c
o oils or grease shall be u
her drilling equipment b
prehole without EPA appr
drill stems have a tenden
in be used on the drill ste
ne drill rig(s) may be stea
nen required.
addition, all downhole dr
ome into contact with the d
hall be cleaned and decor | ckhoe. etc., that is or
s. orilling platform, ho
all be steam clean
one from other haz
used to lubricate dril
eing used over the
roval.
Icy to tighten during
em threads.
m cleaned prior to c
illing and associate
lownhole equipment
ntaminated by the for | ver the borehole (kelly
ist or chain pulldowns,
ed and wire brushed
I rust, soil, and other
cardous waste sites.
I stem threads or any
borehole or in the
drilling, Teflon string
drilling each borehole
d equipment that will
t and sample medium
bollowing procedures. |
| | | | Clean with tap wated detergent, using a bill matter and surface fill hot water washing million water washing in a search of a search of a search of a steam (200 deg Fip) Rinse thoroughly with a pumps (deionized water, orgonist be applied with a pumps (deionized water, orgonist be applied with a search of the did driller will be insperies shall be insperies shall be insperies shall be insperies sandblasted before buildup of rust, hard removed by stearm sandblasting shall be insperies and blasting shall be insperies and | er and laboratory gi
irush. if necessary, f
ins. Steam cleaning
hay be necessary to
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cable. The steam
washer shall be cap
2500 PSI and produ-
lus).
In tap water (potable
sprayer. All other de
ganic-free water, an-
with non-interfering
made of glass, Teffe
econtamination pro-
cted by the site ge
in prior to beginn
ng, drilling, and sam
ore Step #1 if painted
d or caked matter,
n and/or high pres- | ade, phosphate-free
to remove particulate
and/or high pressure
remove matter that is
in flights and drill rods
for sample collection
th on the outside and
cleaner and/or high
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cing hot water and/or
e). Tap water may be
contamination liquids
d solvents), however,
containers. These
on, or stainless steel.
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eologist and/or other
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pling equipment shall
ed, and/or if there is a
etc., that can not be
ssure cleaning. All
o arrival on site. |

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	 All well casing, tree printing and/or writin #1. Emery cloth or printing and/or writin materials without th materials are ordere Well casing, tremie to shall not be solv decontamination pr be cleaned are not 	mie tubing, etc., th ng on them shall be sand paper can be ig. Most well materia e printing and/or wr ed. subing, etc., that are rent rinsed during ocess. Used plastic acceptable and sha	at arrive on-site with removed before Step a used to remove the al suppliers can supply iting if specified when made of plastic (PVC) the cleaning and materials that cannot all be discarded.
	Cleaning and decor a designated area of from the clean equi- cleaning and decor water and/or waster lined with heavy duty runoff of the wash/r excavated, a catch to lined with plastic to of containerized. All screen, and casing, sheeting using saw to completion of the d with the appropriated leader, but only after rinse water has been No solvent rinsates approval is granted separate containers	ntamination of all equation the site, downgrauipment drying and ntamination area signit. The pit and surre- plastic sheeting and inse water into the possin can be constru- contain the waste/rin- cleaning of drill root etc., will be conduct horses or other appr rilling activities, the e-material designate r the pit has been sau pumped into 55-gall signities will be placed in . All solvent rinsates s for proper disposa	uipment shall occur at adient, and downwind storage area. The shall contain a wash ounding area shall be ddesigned to promote bit. If a pit cannot be ucted out of wood and se water until it can be is, auger flights, well the above the plastic opriate means. At the pit shall be backfilled ed by the site project mpled, and the waste/ ion drums for disposal. the pit unless prior is shall be collected in l.
	Tap water (potable) purposes shall be co size so that drilling stop and haul water	brought on the site for ontained in a pre-cle activities can proce	or drilling and cleaning aned tank of sufficient eed without having to
7.0 RECORDS			

Documentation generated as a result of this procedure is collected and maintained in accordance with requirements specified in QAAP 17.1, Records Management.

8.0 ATTACHMENTS

- 8.1 Attachment I Summaries of Additional Decontamination Methods
- 8.2 Attachment II Surface Radioactivity Guides

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	19		Method	Surlace	Action	Technique	Advantages	Disaovantages
Page:	15 01	(page 1 of 4	Vacuum Cleaning	Dry surface	Removes con- taminated dust by suction.	Use conventional vacuum techniques with efficient filter,	Good on dry, porous surfaces, Avoids water reactions.	All dust must be fil- tered out of exhaust Machine is com- taminated
Revision:	0.	ment amination Methods	V.'ater	All nondorous sur- faces (metal painted, plastic, etc.)	Dissolves and erodes.	For large surfaces- Hose with high-pres- sure water at an op- timum distance of 15 to 20 feet Spray ver- tical surfaces at an anote of incidence of 30° to 40°; work from top to bottom to avoid re contamination. Work upwind to avoid	All water equipment may be utilized. Ai- lows operation to be carried out from a dis- tance. Contamina- tion may be reduced by 50%. Water equip- ment may be used for solutions of other decontaminating agents.	Drainage must be controlled Not suitable for porous materials Olied suf- faces cannot be decontaminated Not applicable on dry con- taminated suffaces (use vacuum): not ap- plicable on porous suffaces such as
ure No.:	-400	Attachi onal Deconta				spray. Determine cleaning rate ex- perimentally, if pos- sible; otherwise, use a rate of 4 square teet per minute.		wood, concrete, can- vas. etc. Spray will be contaminated.
Proced	E	es of Additi		All surfaces	Dissolves and erodes.	For small surfaces- Blot liquid and hand- wipe with water and appropriate commer- cial detergent.	Extremely effective if done immediately after spill and on non- porous surfaces.	Of little value in the decontamination of large areas, long- standing contamin- ants, and porous sur- laces.
SAIC FIELD TECHNICAL	PROCEDURE	Summarie	Steam	Nonporous surfaces (especially painted or oiled surfaces)	Dissolves and erodes.	Work from top to bot- tom and from upwind. Clean surface at a rate of 4 square feet per minute. The cleaning efficiency of steam will be greatly in- creased by using detergents.	Contamination may be reduced ap- proximately 90% on painted surfaces.	Steam subject to same limitations as water. Spray hazard makes the wearing of waterproof outfits necessary.

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	ດ		Method	Surface	Action	Technique	Advantages	Disadvantages
Page:	16 of 1	s (page 2 of 4)	Detergents	Nonporous surfaces (metal, painted, glass, plastic, etc.)	Emulsifies con- taminant and in- creases wetting power of water and cleaning efficiency of steam.	Rub surface 1 minute with a rag moistened with detergent solu- tion, then wipe with dry rag; use clean sur- face of the rag for each application. Use	Dissolves industrial film and other materials which hold contamination. Con- tamination may be reduced by 90%	May require personal contact with surface May not be efficient on longstanding con- tamination.
Revision:	0	ment I amination Methods				a power rotary brush with pressure feed for more efficient clean- ing. Apply solution from a distance with a pressure propor- tioner. Do not allow solution to drip onto other surfaces. Mist application is all that is necessary.		
Procedure No.:	FTP-400	Attachr s of Additional Deconta	Complexing Agents	Nonporous surfaces (especially un- weathered surfaces; i.e., no fust or cal- careous growth)	Forms soluble com- plexes with con- taminated material.	Complexing agent solution should con- tain 3% (by weight) of agent. Spray surface with solution. Keep surface moist 30 minutes by spraying with solution peri- odically. After 30 minutes, flush material off with water. Complexing agents may be used	Holds contamination in solution. Con- tamination may be reduced by 75% in 4 minutes on un- weathered surfaces. Easily stored; car- bonates and citrates are nontoxic, noncor- rosive.	Requires application for 5 to 30 minutes Little penetrating power; of small value on weathered sur- faces.
SAIC FIELD TECHNICAL	PROCEDURE	Summaries	Organic Solvents	Nonporous surfaces (greasy or coated sur- faces, paint or plastic finishes, etc.)	Dissolves organic materials (oil, paint, etc.).	agents may be used on vertical and over- head surfaces by ad- ding chemical foam (sodium carbonate or aluminum sulfate). Immerse entire unit in solvent or apply by wiping procedure (see "Detergents").	Ouick dissolving ac- tion. Recovery of sol- vent possible by distil- lation.	Requires good ven- tilation and fire precautions. Toxic to personnel. Material bulk

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	19		Meihod	Surtace	Action		Technique	Advantages	Disaovantages
Page:	17 of 1	s (page 3 of 4)	Inerganic Acios	Metal surfaces (espe- cially with porous deposits: i.e., rust or calcareous growth); circulatory pipe sys- tems	Dissolves aeposits.	porou s	Use dip-bath proce- dure for movable items, Acic should be kept at a concentrate of 1 to 2 normal (9 to 18% hydrochloric, 3 to 6% sulfuric acid).	Corrosive action on metal and porous deposits. Corrosive action may be moderated by addi- tion of corrosion in- hibitors to solution.	Personal hazard. Wear goggies nubber boots, groves, and abrons Good ventila- tion required because of toxicity and ex- plosive gases. Acid
Revision:	o	iment I tamination Methods					Leave on weathered surfaces for 1 hour. Flush surface with water, scrub with a water-detergent solu- tion, and rinse. Leave in pipe circulatory sys- tem 2 to 4 hours; flush with plain water, a water-detergent solu- tion, then again with plain water.		mixtures should not be heated. Possibility of excessive corrosion if used without in- hibitors. Sulfuric acid not effective on cal- careous deposits.
rocedure No.:	FTP-400	Attacr Additional Decon	Acid Mixtures; hydrochloric, sullaric acetic ciffic acids acetates ciffates	Nonporous surfaces (especially with porous deposits); cir- culatory pipe systems	Dissolves deposits.	porous	Same as for inorganic acids. A typical mix- ture consist of 0.1 gal, hydrochloric acid, 0.2 Ib. sodium acetate and 1 gal, water.	Contamination may reduce by 90% in 1 hour (unweathered surfaces). More easi- ly handled than inor- ganic acid solution	Weathered surfaces may require pro- freatment. Same safety precautions as required for inorganic acids
SAIC FIELD P	PROCEDURE	Summaries of /	Caustics: lye (sodium hydroxide calcium hydroxide potassium hydroxide	Painted surfaces e) (horizontal)	Softens pain method).	t (harsh	Allow paint-remover solution to remain on surface until paint is softened to the point where it may be washed off with water. Remove remaining paint with long-hand- led scrapers. Typical paint remover solu- tion: 10 gal. water, 4 Ib. Iye, 6 Ib. boiler compound, 0.75 Ib cornstarch.	Minimum contact with contaminated surfaces. Easily stored.	Personal hazard (will cause burns). Reac- tion slow; thus, it is not efficient on vertical or overhead surfaces. Should not be used on aluminum or mag- nesium.

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18 of 19 Summaries of Additional Decontamination Methods (page 4 of 4) Page: Disadvantages Advantaces Technique Surface Action Method Destructive effect on Contamination may Painted surfaces (ver-Trisodium Phosphate Softens paint (mild Apply hot 10% solupaint Should not be be reduced 10 tical, overnead) method). tion by rubbing and **Revision:** used on aluminum or tolerance in one or wiping procedure magnesium two applications. (see "Detergent"). Ο Attachment I Impracticable for Contamination may Use conventional pro-Nonporous surfaces Removes surfaces. Abrasion porous surfaces bebe reduced to as low cedures, such as cause of penetration a level as desired. sanding, filing, and by moisture. chipping; keep surface damp to avoid dust hazard Procedure No.: Contamination Practical for large sur-Keep sand wet to less-Removes surfaces. FTP-400 Sandblasting Nonporous surfaces spread over area en spread of conface areas. must be removed. tamination. Collect Contamination dust is used abrasive or flush personnel hazard. away with water. Contamination of Hold tool flush to sur-Contaminated waste Removes surfaces: Vacuum Blasting Porous and nonequipment. ready for disposal. traps and controls face to prevent esporous surfaces abrasion cape of contamina-Salest contaminated waste. method. tion. PROCEDURE TECHNICAL SAIC FIELD

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Attachment II Surface Radioactivity Guides

Nuclide1	Removable ^{2,3}	Total ²⁴⁵ (fixed plus removable)	
U-nat, U-235, U-238, and associated decay products.	1,000 dpm/100 cm ² alpha	5,000 dpm/100 cm ² alpha	
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	20 dpm/100 cm ²	500 dpm/100 cm ²	
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	200 dpm/100 cm ²	1,000 dpm/100 2 cm ²	
Beta-gamma emitters (Nuclides with decay modes other than alpha emission or spontaneous fission) except SR-90 and others noted above ⁶ .	1,000 dpm/100 cm ² beta-gamma	5,000 dpm/100 cm ² beta-gamma	

¹ Where surface contamination by both alpha and beta-gamma emitting nuclides exists, the limits established for alpha and beta-gamma emitting nuclides should apply independently.

- ² As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the observed counts per minute by an appropriate background, efficiency, and geometric factors associated with the instrumentation.
- ³ The amount of removable radioactive material per 100 cm² of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. (Note - The use of dry material may not be appropriate for tritium.) When removable contamination on objects of surface area less than 100 cm² is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. Except for transuranics and Ra-226, Ra-228, Ac-227, Th-228, Th-230, and Pa-231 alpha emitters, it is not necessary to use wiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual surface contamination levels are within the limits for removable contamination.
- ⁴ The levels may be averaged over one square meter provided the maximum surface activity in any area of 100 cm² is less than three times the guide values. For purposes of averaging, any square meter of surface shall be considered above the guide <u>G</u> if: (1) from measurements of a representative number of n sections it is determined that $1/n \Sigma_n S_i \ge G$, where S_i is the dis/min-100 cm² determined from measurement of section i; or (2) it is determined that the sum of the activity of all isolated spots or particles in any 100 cm² area exceeds 3G.
- ⁵ For worker and equipment frisking at the K-25 site, Total (Fixed plus removable) surface radioactivity measurements provide the applicable standard.
- ⁶ This category of radionuclides include mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90 which has been separated from the other fission products or mixtures where the Sr-90 has been enriched.

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION FIELD TECHNICAL PROCEDURE

Title: Cleaning and Decontaminating Sample Containers and Sampling Equipment

Procedure No: FTP-405	Revision: 0	Date: 8/30/96	Page 1 of 14
Group Manager:	Date :	QA/QC Officer:	Date:
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1.0 PURPOSE

The purpose of this procedure is to describe decontamination methods and related issues involving the physical removal of chemical and radioactive contaminants from sample containers and sampling equipment.

2.0 <u>SCOPE</u>

This procedure is specifically applicable to the decontamination of the surfaces of sample containers and equipment that come in direct contact with actual samples during sample collection and processing. FTP-400 "Equipment Decontamination" addresses the decontamination of sampling and field equipment that does not directly contact samples.

3.0 REFERENCES, RELATED READING, AND DEFINITIONS

3.1 <u>REFERENCES</u>

- 3.1.1 Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual, U.S. Environmental Protection Agency, Region IV Environmental Services Division, Georgia, February 1, 1991.
- 3.1.2 Science Applications International Corporation Quality Assurance Administrative Procedures (SAIC QAAPs).
- 3.1.3 Science Applications International Corporation Quality Assurance Program Plan (SAIC QAPP).
- 3.1.4 Science Applications International Corporation, Field Technical Procedure (SAIC FTP) 400. Equipment Decontamination.

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3.2 DEFINITIONS

- 3.2.1 <u>Deionized Water</u> Tap water treated by passing through a standard deionizing resin column. The deionized water should contain no heavy metals or other inorganic compounds (i.e., at or above analytical detection limits) as defined by a standard Inductively Coupled Argon Plasma Spectrophotometer scan.
- 3.2.2 <u>Equipment</u> Those items (variously referred to a "field equipment" or "sample equipment") necessary for sampling activities which do not directly contact the samples.
- 3.2.3 <u>Laboratory Detergent</u> A standard brand of phosphate-free laboratory detergent, such as Liquinox, or the equivalent.
- 3.2.4 <u>Organic-free Water</u> Tap water treated with activated carbon and deionizing units or water from a Milli-Q system (or equivalent). This water should not contain pesticides, herbicides, extractable organic compounds, and less than 50 µg/l of purgeable organic compounds as measured by a low-level GC/MS scan. Organic free water should be stored only in glass or Teflon containers and dispensed from only glass, Teflon, or stainless steel containers.
- 3.2.5 <u>Sampling Devices</u> Utensils and other implements used for sample collection and processing that directly contact actual samples.
- 3.2.6 <u>Solvent</u> Pesticide grade isopropanol is the standard solvent used for decontamination in most instances. The use of any other solvent must be justified and approved by the responsible project personnel and documented in the field logbooks.
- 3.2.7 <u>Tap Water</u> This refers to tap water from a tested and approved water system.

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4.0 <u>RE</u>	SPONSIBILIT	TIES						
4.1	GROUP M	ANAGER						
	The Group	The Group Manager is responsible for approving this procedure.						
4.2		SSURANCE/QUALITY C		OFFICER				
	The QA/QC	COfficer is responsible for						
	4.2.1 app	roving this procedure: and						
	4.2.2 verif	ying that this and all appro	opriate procedures	are followed.				
4.3	HEALTH A	ND SAFETY (H&S) OFFI	CER					
	The H&SO H&S policie line manag	fficer is responsible for ensu as and procedures are in ef ement.	iring that appropriate fect and verifying er	e SAIC and contractual forcement of same by				
4.4		OR PROJECT MANAG	<u>ER</u>					
	The Progra	am or Project Manager is r	esponsible for:					
	4.4.1 desi proc	ignating a qualified persor cedure;	n to train personnel	who will be using this				
	4.4.2 ens	uring that all personnel are	e properly trained;					
	4.4.3 ens	uring that this and all appr	opriate procedures	are followed;				
	4.4.4 veri Cer	fying that the appropriate tral Records Facility (CRF	e training records F); and	are submitted to the				
	4.4.5 ens reso	uring that the program/ ources to be performed sa	project has adequ ifely.	uate and appropriate				

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4.5	FIELD MAN	AGER		<u> </u>				
	The Field Ma	anager or designee is res	ponsible for:					
	4.5.1 ensur	ing compliance with the	Sampling and Anal	ysis Plan (SAP);				
	4.5.2 ensur with t	ing that all personnel per his procedure when it is a	form their assigned applicable;	duties in accordance				
	4.5.3 overa	Il management of field ac	ctivities; and					
	4.5.4 ensur	ing that decontamination	activities are perfo	rmed safely.				
5.0 <u>GE</u>	NERAL							
5.1	It is SAIC pol to chemical Occupationa and requiren apply on a p	It is SAIC policy to maintain an effective program to control employee exposure to chemical, radiological, and physical stress which is consistent with Occupational Safety and Health Administration (OSHA) established standards and requirements. Client specific (e.g., Department of Defense) requirements apply on a project specific basis.						
5.2	Any deviatio by the Project documented	Any deviations from specified requirements will be justified to and authorized by the Project Manager and/or the relevant Program Manager, and should be documented on the appropriate field change forms.						
5.3	Deviations fictions for the fit of the fit o	rom requirements will b ne modified process.	e sufficiently docu	mented to allow re-				
5.4	Refer to the	site- or project-specific H	&S pian for relevan	t H&S requirements.				
5.5	Refer to the S	SAP for project/task-spec	cific sampling and a	nalysis requirements.				
5.6	SAIC and subcontractor personnel who use this procedure must provide documented evidence of having been trained in the procedure to the Program or Project Manager for transmittal to the CRF.							
5.7	The objective contaminate uncontaminate to minimize level of deco and liquid wa	ves of decontamination ed surfaces; to minim ated surfaces; to avoid a personnel exposures. T ontamination while minin aste.	n are: to remove lize the spread of ny cross-contamina The intent is to acc nizing the generation	contamination from of contamination to ation of samples; and complish the required on of additional solid				

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- 5.8 As a minimum, safety glasses or goggles, and nitrile or equivalent gloves will be worn while decontaminating equipment. Uncoated Tyvek coveralls, laboratory coat, or splash apron will be worn if justified by contaminant concentration and potential adverse effects. Face shield, heavy duty PVC or equivalent gloves, coated Tyvek or equivalent coveralls will be worn while cleaning with steam or high temperature water. Ground fault circuit interrupters will be used to supply power to any portable electrical equipment in the equipment decontamination area. Solvent rinsing will be conducted in an open, well ventilated area or under a fume hood. No eating, smoking, drinking, chewing, or hand to mouth contact will be permitted during decontamination activities. Refer to the site- or project-specific H&S plan for other relevant H&S requirements. A fifteen minute eyewash will be available within 100 feet of corrosive (concentrated acids or bases) decontamination fluids are used.
- 5.9 Refer to the SAP for project specific decontamination methods and schedules.
- 5.10 Procedures for packaging and disposal of all waste generated during field activities will be described in the project-specific SAP, Waste Management plan (WMP), or other applicable guidelines.
- 5.11 Decontamination of sampling devices will be performed in a designated decontamination area, removed from any sampling location. This designated area must also be in a location free of direct exposure to airborne and radiological surface contaminants.
- 5.12 Decontamination activities will be conducted downwind of the location where clean field equipment, clean sample devices, and sample containers are stored.
- 5.13 Contaminated or dirty sampling devices/sample containers are not stored with clean (decontaminated) sampling devices/sample containers.
- 5.14 Sample containers and sampling devices are segregated from all other equipment and supplies.
- 5.15 Paint or any other coatings must be removed from any part of a sampling device which may either contact a sample or which may otherwise affect sample integrity. After removal of such coatings, the sampling device will then require decontamination by the appropriate method.

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5.16 The br. type.	5.16 The brushes used to clean sampling devices must not be of the wire-wrapped type.								
5.17 For an substitu water ir water a the dete	y of the specific decontamin Ition of a higher grade water In place of deionized water). If Ind organic-free water are les Prgent during the initial rinse.	nation methods that is permitted (e.g., the However, it must be s effective than tap y	t may be used, the e use of organic-free noted that deionized water in rinsing away						
5.18 When surveye	appropriate, it may be requi	red that decontamin designated personne	nated equipment be el.						
5.19 Decont will be s	aminated sampling devices a stored in locations that are pro	nd all filled and emp tected from exposure	ty sample containers to any contaminant.						
5.20 The me sample on the the spe	ethod for decontamination o containers which have been material contaminated, the s cific radionuclides to be remo	f sampling devices exposed to radioact ample medium, the wed.	and the exterior of ive material is based radiation levels, and						
5.21 In refer release criteria	ence to decontaminated samp for unrestricted use is based of should be found in the projec	bling devices and sar on site-specific criteria t work plans.	nple containers, their a. These site-specific						
5.22 Rags us segreg	sed during decontamination m ation. Refer to the project work	ay become a hazardo or plans for hazardous	ous waste and require waste requirements.						
6.0 PROCEDUE	<u>،</u> ۱ <u>۲</u>								
6.1 <u>DECO</u>	NTAMINATION SCHEDULES	2							
6.1.1	Sampling devices must be de field, in order to prevent poter	econtaminated prior ntial contamination o	to being used in the fa sample.						
6.1.2	6.1.2 Sampling devices must be decontaminated between samples to prevent cross-contamination.								
6.1.3	Sampling devices must be de event prior to being taken off-	contaminated at the site	close of the sampling						

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- 6.1.4 An acceptable alternative to cleaning and decontaminating sampling devices is the use of items cleaned or sterilized by the manufacturer that are discarded after use. Care must be exercised to ensure such previously cleaned or sterilized items do not retain residues of chemical or radioactive sterilizing agents that might interfere with analytical techniques.
- 6.1.5 Whenever visible dirt, droplets of liquid, stains, or other extraneous materials are detected on the exterior of a sample container, the exterior surfaces must be decontaminated. This should be done before placing in a sample cooler or shipping container.
- 6.1.6 For sample containers used in controlled access areas, a more rigorous cleaning and/or radiation monitoring may be required before removal from the site. Refer to the project-specific work plan for details.

6.2 DECONTAMINATION METHODS

The following decontamination methods are examples of some of those most commonly used in field investigations. For the specific procedural requirements for any one project, task, or site, refer to the appropriate SAP. Note: The decontamination methods described in this section are for guidance only; the Field Operations Manager will adjust decontamination practices to fit the sampling situation and applicable requirements.

- 6.2.1 Decontaminating the Exterior of Sample Containers in Use
 - 6.2.1.1 Wipe the exterior surfaces of the sample container with disposable rags/toweling or rinse with deionized water.
 - 6.2.1.2 If rinsing with deionized water, then the exterior of the sample container must be wiped dry with disposable rags/toweling.
 - 6.2.1.3 All visible dirt, droplets of liquid, or other extraneous materials must be removed.
 - 6.2.1.4 For containers used in controlled access areas or where the sample media is difficult to remove (e.g., sludge), a more rigorous cleaning and/or radiation monitoring may be required. Refer to the project-. task-, or site-specific Work Plan for details.

SAIC FIELD		Procedure No.:	Revision:	Page:		
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	6 .2 .1.	5 This decontaminati sample location bef sample cooler or sh	on procedure will ore placing the sami ore placing the sami	be performed at the aple container in the		
6.2.2	Decor Used Analys	ntaminating Stainless St to Collect Samples for Tr ses.	eei, Teflon, or Met race Organic Comp	al Sampling Devices ounds and /or Metals		
	6.2.2.	1 Clean with a tap wat phosphate-free dete Use a brush to rem	er and laboratory de ergent, such as Liq love particulate ma	tergent solution. Use uinox, or equivalent. tter and surface film.		
	6.2.2.2	2 Rinse thoroughly wi	Rinse thoroughly with organic-free water.			
	6.2.2.3 Rinse twice with solvent (pesticide-grade isopropane			grade isopropanol).		
	6.2.2.4	4 Allow to air dry for 2	4 hours, if possible.			
	6.2.2.5	5 If it is not possible t with organic-free wat	to air dry for 24 ho ter and allow to air dr	urs, then rinse twice y as long as possible.		
	6.2.2.6	5 Wrap sampling dev facing outward). Th sampling devices du	ices with aluminum his is done to prevenuing transport and s	foil (with shiny side ent contamination of storage.		
	6.2.2.7	When a sampling of contain oil, grease, of be necessary to ri- approved solvent (of SAP) before initiatin may be necessary to sampling device prior If the sampling device the above means, it	device is used to o or other hard to rem nse the device se ne which meets the g decontamination. steam clean, wire be or to using this deco se cannot be adequa must be discarded.	collect samples that ove materials, it may veral times with an requirements of the In extreme cases it rush, or sandblast the ntamination method. ately cleaned utilizing		
6.2.3	Decon Sampi	taminating Glass Samp es for Trace Organic Co	ling Devices Used mpounds and/or Me	for the Collection of etals Analyses.		

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SAIC FIELD	F	Procedure No.:	Revision:	Page:
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6	5 .2.3 .1	Glass sampling dev laboratory detergent any particulate matt	ices will be washed t and hot water usiner or surface film.	thoroughly with ng a brush to remove
6	5.2.3.2	Rinse thoroughly wi	th hot tap water.	
6	5.2.3.3	Rinse thorou	anly with	tap water.
6	6.2.3.4	Rinse twice with so hours.	ivent and allow to	air dry for at least 24
6	5.2.3.5	Wrap with aluminum is done to prevent cor to the field.	foil (with shiny side ntamination during st	facing outward). This orage and/ortransport
Note: W o si o b d d c d	when a sain by other has everal time of the SAIn be neces device price annot be discarded	mpling device is used ard to remove materia nes with an approved s P) before initiating de sary to steam clean. or to using this decont a adequately cleaned I.	to collect samples th ils. it may be necess solvent (one which m contamination. In c wire brush, or sai amination method. d utilizing the abov	hat contain oil, grease, ary to rinse the device eets the requirements extreme cases it may indblast the sampling lf the sampling device e means, it must be
6.2.4 D S	Decontan Samplers	nination of Silastic R and Other Peristaltic	ubber Pump Tubin Pumps.	g Used in Automatic
N T W	New clea The silasti where the	ned tubing must be u ic rubber pump tubing sample does not con	used for each autor need not be replace	natic sampler set-up.
u Note: N b n	lew tubin lew tubin de used in new tubin	ourging purposes (i.e. g (certified clean by t n lieve of cleaning. N g used for each sam	not being used to he manufacturer, o lew tubing may be pling event or locat	ere the pump is being collect samples). r medical grade) may dedicated to a well or ion.
u Note: N b n 6	lew tubin be used in bew tubin 5.2.4.1	ourging purposes (i.e. g (certified clean by t n lieve of cleaning. N g used for each sam Flush tubing with hot detergent.	not being used to he manufacturer, o lew tubing may be o pling event or locat	ere the pump is being collect samples). r medical grade) may dedicated to a well or ion.
u Note: N b n 6	Sed for p lew tubin be used in Sew tubin S.2.4.1	ourging purposes (i.e. g (certified clean by t n lieve of cleaning. N g used for each sam Flush tubing with hot detergent. Rinse tubing thorou	not being used to he manufacturer, o lew tubing may be o pling event or locat tap water and phos ghly with hot tap wa	ater.

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SAIC FIELD		Procedure No.:	Revision:	Page:
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	6.2.4.	4 Install tubing in auto	omatic sampler or p	eristaltic pump.
6.2.5	Deco	ntamination of Teflon Sai	mple Tubing.	
	Use o samp	only new Teflon tubing de les for organic compound	contaminated as fo ds analyses:	llows for collection of
	6.2.5.	1 Teflon tubing may cleaning to simplify	be pre-cut in conve handling.	enient lengths before
	6.2.5.	2 Rinse outside of tub	oing with solvent.	
	6.2.5.	3 Flush interior of tubi	ing with solvent.	
	6.2.5.	4 Dry overnight using	a drying oven, if ap	oplicable.
	6.2.5.	5 Wrap tubing and ca plastic bag to pre	p ends with alumin event contaminati	um foil, or store in a ion during storage.
6.2.6	Deco	ntamination of Polyvinyl (Chloride (PVC) San	nple Tubing
	Use o	only new tubing		
	6.2.6	1 Polyvinyl chloride tul compounds are not	bing will be used sele of concern.	ectively where organic
	6.2.6	2 Tubing will be stored from this container	d in its original conta until needed.	iner and not removed
	6.2.6	.3 The tubing will be fl to remove any resid process.	ushed immediately dues from the manu	before use facturing or extruding
	6.2.6	4 Discard tubing after	ruse in sampling .	
6.2.7	Deco	ntamination of Stainless	Steel Tubing	
	6.2.7	.1 Wash with laborate narrow, bottle brush	ory dete <mark>rgent and</mark> n. Use hot water, if	water using a long, available.

C

\sim	SAIC FIELD TECHNICAL		Procedure No.:	Revision:	Page:
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	6	6.2.7.2	Rinse thoroughly wi	th tap water. Use	hot water, if available.
	6	6.2.7.3	Rinse thoroughly wi	th deionized water	
	6	5 .2. 7.4	Rinse twice with sol	vent	
	6	6 .2. 7.5	Allow to air dry for 2	4 hours. if possible	9.
	6	5 .2 .7.6	If it is not possible to with organic-free wa	air dry for 24 hours ter and allow to dry t	, then rinse thoroughly for as long as possible.
i	6	5 .2. 7.7	Wrap with aluminun This is done to preve	n foil (with the shiny nt contamination of	v side facing outward). tubing during transport
	Note: W h v c ti a	When the t nard to re with an a cases, it r ubing pr adequate	ubing is used to collect emove materials, it may pproved solvent before may be necessary to solven for to using this decoupled to the solution of the solution	t samples that conta ay be necessary to re initiating deconta steam clean, wire b contamination met e above means, it	ain oil, grease, or other o rinse it several times amination. In extreme orush, or sandblast the hod. If it cannot be must be discarded.
	6.2.8	Decontar	nination of Glass Tub	bing	
	ι	Jse only	new glass tubing, de	contaminated as fo	bliows prior to use:
	6	6.2.8.1	Rinse thoroughly wi	th approved solver	nt.
	6	5.2.8.2	Air dry for at least 2	4 hours.	
	. 6	5.2.8.3	Wrap tubing with alu to prevent contamin	minum foil (with shir lation during storag	ny side facing outward) ge.
	6	5.2.8.4	Discard tubing after	use in sampling.	
	6.3 <u>QUALIT</u>		[ROL		
	6.3.1 T n c C e	The quation monitore container Organic-1 extractab	lity of the deionized d by collecting sam s and submitting them free water should be single, or purgeable com	and organic-free oples in standard n to the laboratory fo ubmitted for low-lev pounds analyses, a	water used may be precleaned, sample or a standard ICP scan. el pesticide, herbicide, as appropriate.

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6.3.2 Effectiveness of the decontamination procedures is monitored by submitting rinse water to the laboratory for low-level analysis of the parameters of interest. An attempt should be made to select different sampling devices, each time devices are washed, so that a representative sampling of all devices is obtained over the length of the project. Note in the field logbook the devices being used for the QC rinsate.

7.0 <u>RECORDS</u>

Documentation generated as a result of this procedure is collected and maintained in accordance with requirements specified in QAAP 17.1, Records Management.

8.0 ATTACHMENTS

- 8.1 Attachment I Field Checklist
- 8.2 Attachment II Allowable Residual Surface Contamination Limits for Unrestricted Release

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	F 1 P-405	U	15 01 14					
Attachment I Field Checklist								
Logbook								
Safety Glass Monogoggie	ses or PS							
Gloves								
Safety Shoe	S							
Black, Indelil	ble Pen							
Plastic Shee	ts							
Decontamina	ation Equipment							
Health and S	Safety Plan							
Sampling an	id Analysis Plan							
Appropriate and Equipm	Containers for Waste							
Monitoring Ir	nstruments							

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Attachment II Allowable Residual Surface Contamination Limits for Unrestricted Release						
Nuclide (Average ^{e.c} (dpm/100 cm²)	Maximum ^{elle} (dpm/100 cm²)		Ren (dpr	noveable ^{b. •} n/100 cm²)	
U-nat, U-235, 5 U-238, and associated decay products	5,000 alpha	15.000) ainna	1.00	10 alpha	
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231	100	300		20		
Ac-227, I-125, I-129, Th-nat, Th-232, Sr-90, Ra-223, Ra-234, U-232, I-126, I-131, I-133	1.000	3.000		200		
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except SR-90 and others noted above.	5.000 beta- gamma	15.00(gamm) beta- la	1,00 garr)0 beta- ima	
a Where surface conta established for alpha	amination by both alpha - and beta-gamma-emit	a- and Iting nuc	beta-gamma emit clides should appl	ting i y inde	nuclides exists, the limits ependently.	
 As used in this table material as determine background, efficience 	e. dpm (disintegrations ed by correcting the cou cy, and geometric factor	per min ints per rs assoc	ute) means the r minute observed clated with the inst	ate o by ar trume	f emission by radioactive n appropriate detector for entation.	
 Measurements of ave objects of less surface 	erage contaminant shouse area, the average sho	uid not b buid be	e averaged over i derived for each s	more such (than 1 square meter. For object.	
d The maximum contai	mination level applies to	o an are	a of not more that	n 100	cm².	
e The amount of remo determined by wipin pressure, and asses instrument of known determined, the per should be wiped.	byable radioactive cont ing the area with dry fill ssing the amount of r efficiency. When remo- tinent levels should be	aminati ter pap radioact ovable (e reduc	on per 100 cm ² (er or soft absorb live material on f contamination on- ced proportionally	of the ent p lhe w objec and	e surface area should be aper, applying moderate vipe with an appropriate its of less surface area is the entire surface area	
Source: US NRC Regula	atory Guide 1.86. June	1974				

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SCIENCE APPLICATIONS INTERNATIONAL CORPORATION. FIELD TECHNICAL PROCEDURE Title: Aguifer Testing by Slug Test Method Page 1 of 6 Date: 6/30/93 Procedure No: FTP-376 Revision: 0 Date: Group Manager: Date : OA/QC Officer: 9/93 167 men 1.0 PURPOSE The purpose of this procedure is to describe the slug test method for determining the capacity of an aquifer to yield water. 2.0 <u>SCOPE</u> This test applies to tests which provide data on hydraulic conductivity. 3.0 REFERENCES, RELATED READING, AND DEFINITIONS 3.1 REFERENCES 3.1.1 Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual, U.S. Environmental Protection Agency, Region IV Environmental Services Division, Georgia, February 1, 1991. 3.1.2 Groundwater and Wells, Second Edition, Johnson Division, St. Paul, Minnesota, 1986. 3.1.3 Applied Hydrogeology, Charles E. Merrill Publishing Company, Columbus, Ohio, 1980. 3.1.4 Groundwater Engineering, McGraw-Hill Book Company, New York, 1986. 3.1.5 Science Applications International Corporation Quality Assurance Administrative Procedures (SAIC QAAPs). 3.1.6 Science Applications International Corporation Quality Assurance Program Plan (QAPP). 3.1.7 Science Applications International Corporation Environmental Project Management Manual (SAIC EPMM).

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3.1.8 Scier (SAIC	nce Applications Internation C FTP) 400, Equipment D	nal Corporation Field	d Technical Procedure
3.1.9 Scier (SAIC	nce Applications Internatio C FTP) 625, Chain-of-Cu	nal Corporation Fiel stody.	d Technical Procedure
3.1.10 Scier (SAIC	nce Applications Internatio C FTP) 1215, Use of Fiel	nal Corporation Fiel d Logbooks.	d Technical Procedure
3.2 DEFINITION	<u> 15</u>		
None.			
4.0 <u>RESPONSIBILIT</u>	IES		
4.1 SAIC CORF	PORATE OFFICER IN C	HARGE	
The SAIC (Aquifer Tes	Corporate Officer in Cha ting by Slug Test Method	arge is responsible	for the oversight of
4.2 GROUP MA	ANAGER		
The Group	Manager is responsible f	or approving this pr	ocedure.
4.3 QUALITY A	SSURANCE/QUALITY	CONTROL (QA/QC) OFFICER
The QA/QC	Officer is responsible fo	r:	
4.3.1 appr	oving this procedure and		
4.3.2 verif	ying that this procedure i	s being implemente	d.
4.4 <u>HEALTH A</u>	ND SAFETY (H&S) OFF	ICER	
The H&S contractual of same by	Officer is responsible for H&S policies and procedu line management.	or ensuring that a ures are in effect and	ppropriate SAIC and verifying enforcement

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	4.5	5 PROGRAM OR PROJECT MANAGER						
		The Progra	m or Project Manager is r	esponsible for:				
		4.5.1 ensu	iring that all personnel are	properly trained;				
		4.5.2 ensu	iring that this and all appro	opriate procedures	are followed; and			
		4.5.3 verif Cen	ying that the appropriate ral Records Facility (CRF	training records a	are submitted to the			
	4.6	FIELD MAN	IAGER					
		The Field M	lanager is responsible for					
		4.6.1 ensu with	ring that all personnel per this procedure when it is a	form their assigned applicable;	duties in accordance			
		4.6.2 ensu	iring compliance with the	Sampling and Analy	sis Plan (SAP); and			
		4.6.3 over	all management of field a	ctivities.				
5.0	GEN	IERAL						
	5.1	It is SAIC exposure to U.S. Depa Administrat	policy to maintain an effective chemical, radiological, an rtment of Energy (DOE) ion (OSHA) established s	ective program for nd physical stress wi and Occupationa tandards and requir	control of employee hich is consistent with Safety and Health ements.			
	5.2	Any deviation the Project	on from specified requirem Manager and/or the relev	nents will be justified ant Program Manag	to and authorized by per.			
	5.3	Deviations creation of	from the requirements will the modified process.	l be sufficiently doc	umented to allow re-			
	5.4	Refer to the	site- or project-specific H	I&S Plan for relevar	t H&S requirements.			
	5.5	Refer to the	SAP for project/task-spec	cific sampling and a	nalysis requirements.			

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5.6	6 SAIC a docum or Proj 4.5.3.	and subcontractor personnented evidence of having be ect Manager for transmittal	el who use this pro en trained on the proc to the CRF in accord	cedure must provide cedure to the Program lance with subsection			
5.7	7 Informa riser al testing obtaine	Information on the well design, including total depth, screen length and dept riser and screen diameters, and diameter of sand pack is required prior testing. In addition, other information regarding the aquifer should also l obtained (e.g., depth to water, aquifer thickness).					
5.8	8 During rise or	testing, water is withdrawn f decline of the water level wi	rom or added to a we thin the well is record	Il and the subsequent led.			
5.9	9 During injecter	the slug test, a known volu d into or withdrawn from a w	me of water (referred ell.	to as a slug) is eithe			
5.	10 The rat slug is manua rate of	 0 The rate at which the water level rises or falls after introducing or withdrawing the slug is recorded in a depth-versus-time plot. The measurements are made either manually, using a tape measure, or with a high-pressure transducer system. The rate of change is controlled by the characteristics of the formation. 1 Sampling tools and equipment will be protected from sources of contamination prior to testing and decontaminated prior to and between testing locations a specified in FTP-400, Equipment Decontamination. 					
5.	11 Sampli prior to specifie						
6.0 <u>P</u> I	ROCEDU	RE					
6.	1 <u>PREP</u>	ARATION					
	6.1.1	Don appropriate personal pr	otective equipment pr	ior to any field activities			
	6.1.2	Place plastic sheeting aro	und work area to protentially contaminate	event equipment from d surfaces.			
	6.1.3	Obtain the following inform	ation about the well to	be pumped/purged:			
		 a) well location; b) well specifications (di interval etc.; c) depth to groundwate 	ameter,depth,extent; er in well; and	and location of screene			
		d) description of mater	ial in which the well is	s screened.			

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	6.1.4	If the slug test is to be conducted using pressure transducers, all associated equipment, including data logger(s), will be obtained for use in pumping/observation well prior to installing pressure transducers.						
6.2	SLUG	TEST	TEST					
	6.2.1	The s well d	The slug test is not conducted until at least a minimum of 24 hours after well development.					
	6.2.2	Appro the gr	Appropriate arrangements must be made for discharge of the water (to the ground, to a 55-gallon drum, etc.).					
	6.2.3	lf a pu	If a pump must be utilized, a discharge line will also be necessary.					
	6.2.4	The slug tests are conducted using a pressure transducer connected to a digital data logger. The static water level is measured and a slug of known volume is placed into, or withdrawn from, the well. This will cause the water level in the well to increase or decrease accordingly. The test is continued until the water level reaches at least 90% of the static water level. The time intervals for taking water level measurements will be stated in the SAP.						
	6.2.5	The d data a Hvors a test Bouw check	ata stored in the data log are evaluated using one lev and/or Bouwer and F ed monitoring well is sc er and Rice method is us ed with hand calculations	ger are transferred i or more slug test lice theories of aqui reened across the ed to evaluate the o s.	nto a computer. The programs based on fer characteristics. If water table, only the lata. The results are			
	6.3	Comp proced Custo	lete field logbook and ch dures FTP-1215, Use of l dy.	ain-of-custody form Field Logbooks, and	s in accordance with FTP-625, Chain-of-			
(6.4	Sampli of con in FTF	ng tools, instruments, an tamination prior to use ar 2-400, Equipment Decon	d equipment are pro id decontaminated a tamination.	otected from sources after use as specified			

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7.0 <u>RECORDS</u>

Documentation generated as a result of this procedure is collected and maintained in accordance with requirements specified in QAAP 17.1, Records Management.

8.0 ATTACHMENTS

None.

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Section 5 QAPP

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QUALITY ASSURANCE PLAN

SECTION 5

RCRA FACILITY INVESTIGATION WORK PLAN

FOR

THE SCOTTS COMPANY 14111 Scottslawn Road Marysville, Ohio 43041

June 11, 1999

SIGNATURE PAGE

This Quality Assurance Project Plan (QAPP) has been prepared for the Scotts Company (Scotts) by Science Applications International Corporation (SAIC). The Scotts Facility is located in Marysville, Ohio. This signature page has been prepared to ensure that the desired content and level of detail are achieved for the RCRA Facility Investigation (RFI). The following have reviewed and approved this document:

Approved by:		
	Gary Daugherty	Date
	The Scotts Company Corporate Environmental Manager	
Approved by:		
	SAIC Project Manager	Date
Approved by:		
· · · ·	Ohio EPA Project Manager	Date
Approved by:		
• _	Laboratory Director	Date

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ACRONYMS

ASTM	American Society for Testing Materials
CA	correction action
COC	chain-of-custody
COPC	chemical of potential concern
DOT	Department of Transportation
DQO	data quality objective
FCO	field change order
IDW	Investigation derived waste
LCS	laboratory control sample
LOR	letter-of-receipt
M&TE	measuring and testing equipment
MDL	method detection limit
MS/MSD	matrix spike/matrix spike duplicate
NCR	nonconformance report
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Testing
OEPA	Ohio Environmental Protection Agency
PCB	polychlorinated biphenyl
QA	quality assurance
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
QC	quality control
QCSR	Quality Control/Summary Report
RFI	RCRA Facility Investigation
RPD	relative percent difference
SAIC	Science Applications International Corporation
SOP	standard operating procedure
SSHO	site safety and health officer
SSHP	site safety and health plan
SVOC	semi-volatile organic compound
TCLP	toxicity characteristic leaching procedure
VOC	volatile organic compound

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5.0 QUALITY ASSURANCE PROJECT PLAN

5.1 INTRODUCTION

This document is a part of the RCRA Facility Investigation (RFI) Work Plan for the Scotts Company Marysville, Ohio facility. This RFI is being conducted to evaluate the environmental impact of Landfills 1 to 5 Field Broadcast Areas 1 and 2; Ponds 2, 3, 6, 7, and 8; and Crosses Run. Investigation work at the Scotts facility started in December 1996 and is ongoing. Recent negotiations with Ohio Environmental Protection Agency (Ohio EPA) have determined that historical and proposed investigations will be integrated to ensure data quality objectives are met. The purpose of this document is to detail the intended objectives and to specify the field and laboratory procedures necessary to collect, analyze, verify, and ensure the quality of data collected. The data collected will support the selection of appropriate corrective measures.

The RFI Work Plan consists of the following sections or plans:

- Introduction
- Description of Current Conditions (DOCC). This includes a brief summary of the following reports previously submitted to the Ohio EPA including:
 - Hydrogeologic Investigation of Former Disposal Sites, November 1996 Groundwater Monitoring Well Installation Results, The Scotts Company, Marysville, Ohio, December 1996, Burgess & Niple, Limited.
 - Phase I Environmental Site Assessment, The Scotts Company, Marysville, Ohio, July 3, 1997, Burgess & Niple, Limited.
 - Groundwater Monitoring Well Installation and Waste/Stream Sediment Characterization, The Scotts Company, Marysville, Ohio, April 1998, Burgess & Niple, Limited.
- Objectives of the Investigation
- Field Sampling Plan
- Quality Assurance Project Plan (QAPP)
- Health and Safety Plan
- Data Management Plan
- Baseline Risk Assessment Methodology
- Project Management Plan
- Public Involvement Plan
- Schedule
- Corrective Technology Plan

This QAPP presents the organization, objectives, functional activities, and specific QA and quality control (QC) activities associated with the Work Plan for the Scotts RFI. It describes the specific protocols that will be followed for sampling, sample handling and storage, chain of custody, and laboratory analysis. This plan also presents details regarding data quality objectives for the project,

sampling and preservation procedures for samples collected in the field, field and sample documentation, sample packaging and shipping, and laboratory analytical procedures for all media sampled.

All QA/QC procedures will be in accordance with applicable professional technical standards, Ohio EPA requirements, government regulations and guidelines, and specific project goals and requirements. This QAPP is prepared by Science Applications International Corporation (SAIC) in accordance with Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (EPA 1991), EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations (EPA 1994a), Guidelines and Specifications for Preparing Quality Assurance Project Plans (EPA 1994a).

Sections 1, 2, and 3 of the Work Plan contain background information and the project description. A discussion of site history, past data collection activities, and existing site data are contained in Section 2 of the Work Plan along with the project scope and objectives in Section 3. Primary project organization and responsibilities are presented in Section 5.2 of this QAPP and Section 9 of the Work Plan. Sampling design, procedures, methods, and rationales are discussed in detail in the Field Sampling Plan (FSP), Section 4 of the Work Plan. Sample matrix types, analytical parameters, and analytical methods are summarized in Table 5.1 of this QAPP. Specific delineation of sample numbers, QA sample frequencies, and field QC sample frequencies have been designated for this investigation.

5.1.1 **Project Description**

This project consists of the Scotts Marysville, Ohio RFI with the objective of defining the nature and extent of releases from thirteen investigative units at the site. The IUs include Landfill Nos. 1 through 5; Field Broadcast Areas 1 and 2; Former Pond Nos. 2, 3, 6, 7, and 8; and Crosses Run. The RFI will consist of sampling and data collection activities to establish source (the extent of waste) boundaries; determine character, type, and extent of constituents derived from the waste disposal areas; and identify all significant pathways for migration. Impacted soils and other media will be addressed in Corrective Measures.

The specific objective of the RFI is to determine the nature and extent of constituents of concern in the environment resulting from waste disposal activities at the IUs. In addition, the RFI will provide necessary data to support implementation of remedial measures at the Scotts facility, as it relates to these IUs. To achieve these objectives, samples of waste, soil, groundwater, surface water, and sediments will be collected and analyzed. Table 5.1 includes a summary of samples that will be collected and analyzed for this RFI.

5.1.2 Site Description

Detailed project and site descriptions are included in previous documents submitted to Ohio EPA as outlined in Section 2. The three referenced reports, previously submitted to Ohio EPA, describe the site history. Understanding the geology and hydrogeology is considered an integral part of the objectives.

The geology and hydrogeology of the site, specifically at the identified waste disposal areas and those areas affected by the migration of waste constituents, are discussed in previous reports and are

specifically detailed in Section 2. Additional investigation work is based on the geology and hydrogeology of the site.

The site is characterized by dense glacial till deposits overlying Silurian Bedrock. The mixture of silt and clay with only minor amounts of sand and gravel does not provide a potable water source in the area. Production and residential wells are completed in bedrock. Groundwater at the site is generally encountered at depths greater than 20 feet below the surface (ft bls), where thin sand and gravel seams are encountered. However, thin shallow saturated zones are present in the vicinity of the wastewater treatment plant ponds at depths ranging from 10 to 15 ft bls. Groundwater flows to the southeast across the site under a fairly consistent hydraulic gradient of 0.0015. Although groundwater encountered at depths greater than 20 ft bls has not been affected by constituents from the waste areas, the data indicates that groundwater in shallow sand seams (10 to 15 ft bls) near Landfill No. 1 contains waste constituents.

5.1.3 Site History And Background

Details regarding site history and background are included in previous reports and in Section 2. Waste, soil, groundwater, surface water, and sediment analytical results of previous sampling are included. The nature and extent of waste has been partially defined based on the previous data. The extent of waste constituents from the IUs in soil, sediment, surface water, and groundwater has been assessed. It was determined through negotiations with Ohio EPA, that additional soil sampling, as well as investigating the potential for additional shallow groundwater impacts, is necessary to adequately define the nature and extent of impacts from the waste areas and to meet the RFI objectives. Since the objectives of previous work are the same as those for the RFI, historical data were used to support and define the additional scope of work described in the work plan.

5.2 PROJECT ORGANIZATION AND RESPONSIBILITIES

The organizational chart shown in Figure 9.1 in Section 9 of this RFI Work Plan outlines the management structure that will be used to implement the project. The functional responsibilities of key personnel are described in the following parts of this section. The assignment of personnel to each project position will be based on a combination of (1) experience in the type of work to be performed, (2) experience working with Ohio EPA personnel and procedures, (3) a demonstrated commitment to high quality and timely job performance, and (4) staff availability.

5.2.1 SAIC Project Manager

The SAIC Project Manager has direct responsibility for implementing the Work Plan, including all phases of work plan development, field activities, data management, and report preparation. This individual also will provide the overall management of the project, and serve as the technical lead and point of contact with the Scotts' Project Manager. These activities will involve coordinating all personnel working on the project, interfacing with Scotts' personnel, and tracking project budgets and schedules. The SAIC Project Manager will also develop, monitor, and fill project staffing needs, delegate specific responsibilities to project team members, and coordinate with administrative staff to maintain a coordinated and timely flow of all project activities.

5.2.2 SAIC Quality Assurance/Quality Control Officer

The SAIC Quality Assurance/Quality Control (QA/QC) Officer is responsible for the project QA/QC in accordance with the requirements of the project QAPP, other work plan documentation, and appropriate management guidance. This individual is responsible for participating in the project field activity readiness review; approving, evaluating, and documenting the disposition of Nonconformance Reports (NCRs); overseeing and approving any required project training; and designing audit/surveillance plans followed by supervision of these activities. The SAIC QA/QC Officer reports directly to the SAIC Project Manager.

5.2.3 SAIC Site Health And Safety Officer

The SAIC Site Safety and Health Officer (SSHO) is responsible for ensuring that health and safety procedures designed to protect personnel are maintained throughout the field activities. This will be accomplished by strict adherence to the project Site Safety and Health Plan (SSHP), which has been prepared as Section 6 of this RFI Work Plan. This SSHO will have the authority to halt field work if health and/or safety issues arise that are not immediately resolvable in accordance with the project SSHP. The SSHO reports directly to the SAIC Project Manager.

5.2.4 SAIC Laboratory Coordinator

The SAIC Laboratory Coordinator is responsible for coordination of sample shipment to the laboratory(s), and subsequent chemical analysis and reporting performed by the subcontract laboratories, in accordance with the requirement defined in the QAPP. This individual will be responsible for obtaining required sample containers from the laboratories for use during field sample collection, resolving questions the laboratory may have regarding QAPP requirements and deliverables, and coordination of data reduction, validation, and documentation activities related to sample data package deliverables received from the laboratories. The SAIC Laboratory Coordinator reports directly to the SAIC Project Manager.

5.2.5 SAIC Field Manager

The SAIC Field Manager is responsible for implementing all field activities in accordance with the FSP and the QAPP. This individual is responsible for ensuring proper technical performance of drilling operations and field sampling activities, adherence to required sample custody and other related QA/QC field procedures, coordination of field personnel activities, management of investigative-derived wastes, checks of all field documentation, and preparation of Field Change Orders (FCOs) if required. The SAIC Field Manager reports directly to the SAIC Project Manager except in regard to QA/QC matters that are reported directly to the SAIC QA/QC Officer.

5.2.6 SAIC Data Manager

The SAIC Data Manager, and data management personnel will be responsible for managing the field and analytical data generated during the project. The data management team will be responsible for the accumulation, control, reduction, validation, documentation, and storage of project data in accordance with the Data Management Plan. The SAIC Data Manager also will assist the SAIC QA/QC Officer in the review of laboratory procedures if required. The SAIC Data Manager reports directly to the SAIC Project Manager.

5.2.7 SAIC Field Personnel

In addition to the SAIC Field Manager, other SAIC field personnel participating in the implementation of field activities are anticipated to be site geologists and sampling technicians. These individuals, in coordination with field subcontractor personnel, will be responsible for performance of drilling operations, collection of soil, groundwater, surface water, biota, etc. and preparation of field logbooks and other required documentation. These individuals will be responsible for performing all field activities in accordance with the FSP and QAPP, and will report directly to the SAIC Field Manager.

5.2.8 Subcontractor Field Personnel

Subcontractor field personnel, under the supervision of the SAIC Field Manager, will be responsible for performing their specific scopes of work that have been derived from the RFI Work Plan. These individuals will be required to review applicable sections of the Field Sampling Plan, QAPP, and the entire SSHP, prior to field mobilization. All subcontractor field personnel report directly to the SAIC Field Manager who will be responsible for ensuring that all subcontractor activities comply with project requirements.

5.2.9 Subcontracted Laboratory Support

Analytical laboratory support specific to these investigations will be provided by a subcontractor laboratory. Relevant QA Manual, laboratory qualification statements, certifications, and license documentation are available upon request.

Organization charts outlining the key laboratory personnel and organization are provided in the analytical laboratories' QAP. The responsibilities of key personnel are described in the following paragraphs. The assignment of personnel to each position will be based on a combination of (1) experience in the type of work being performed, and (2) a demonstrated commitment to high quality and timely job performance.

Prior to commencement of field activities for the project, SAIC will send a complete copy of the work plan including this QAPP to all subcontracted laboratories.

5.2.10 Laboratory Quality Assurance/Quality Control Manager

The subcontractor Laboratory QA/QC Manager is responsible for the laboratory QA/QC in accordance with the requirements of this QAPP in conjunction with the established laboratory QA Program. In coordination with the SAIC Laboratory Coordinator, this individual will be responsible for documenting that samples received by the laboratory are analyzed in accordance with required methodologies, that instrument calibration is performed properly and documented, that field and internal laboratory QC samples are analyzed and documented, and that all analytical results for both field and QC samples are reported to SAIC in the format required in the laboratory scope of work and QAPP. This individual is also responsible for processing laboratory NCRs in a timely manner and for implementing Corrective Action Report recommendations and requirements. The Subcontractor Laboratory QA/QC Manager reports directly to the SAIC Laboratory Coordinator for issues related to this project.

5.2.11 Laboratory Project Manager

The responsibilities of each subcontract laboratory Project Manager include the following: initiation and maintenance of contact with SAIC on individual job tasks; preparation of all laboratoryassociated work plans, schedules, and manpower allocations; initiation of all laboratory-associated procurement for the project; provision of day-to-day direction of the laboratory project team including analytical department managers, supervisors, QA personnel, and data management personnel; coordination of all laboratory related financial and contractual aspects of the project; provision of formatting and technical review for all laboratory reports; provision of day-to-day communication with SAIC; provision of final review and approval on all laboratory analytical reports to SAIC; and response to all post project inquires.

5.2.12 Laboratory Manager

The responsibilities of each subcontract Laboratory Manager include the following: coordination of all analytical production activities conducted within the analytical departments; working with the Laboratory Project Manager to ensure all project objectives are met; provision of guidance to analytical department managers; and facilitation of transfer of data produced by the analytical departments to the report preparation and review staff for final delivery to the client.

5.3 DATA QUALITY OBJECTIVES

The overall project objective is to develop and implement procedures for field sampling, chain of custody (COC), laboratory analysis, and reporting. These procedures will provide results to be used in site evaluation and assessment leading to remediation which is technically sound and legally defensible. Procedures for sampling, COC, laboratory instrument calibration, laboratory analysis, reporting of data, internal QC, audits, preventive maintenance of lab and field equipment, and corrective action are described in other sections of this QAPP. The purpose of this section is to address the objectives for data accuracy, precision, completeness, representativeness, and comparability. The FSP (Section 4) identifies specific task objectives as they relate to the site investigation.

Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the quality of data required to support decisions made during investigation activities, and are based on the end uses of the data being collected.

5.3.1 **Project Objectives**

General objectives are as follows:

- (1) To provide data of sufficient quality and quantity to document the horizontal and vertical extent of contamination.
- (2) To provide data of sufficient quality to meet applicable State of Ohio concerns.
- (3) To ensure samples are collected using approved techniques and are representative of existing site conditions.

- (4) To specify QA/QC procedures for both field and laboratory methodology to meet guidance document requirements.
- (5) Provide sufficient and appropriate quality data to estimate quantities of contaminated media and evaluate potential clean-up technologies.

5.3.2 Quality Assurance Objectives for Measurement Data

An analytical DQO summary for these investigations is presented in Tables 5.2 and 5.3. All QC parameters stated in the specific SW-846 methods will be adhered to for each chemical listed. Laboratories are required to comply with all methods as written. The lab must maintain complete and up-to-date standard operating procedures (SOPs) and submit them for review, if requested.

As per the new EPA guidance (1993a), which now supersedes all other documents in this discipline, a combination of Screening Level and Definitive Level data will be required for this project. Definitive data represent data generated under laboratory conditions using EPA-approved procedures. Data of this type, both qualitative and quantitative, are used for determination of source, extent, or characterization and to support evaluation of remedial technologies and risk assessment.

5.3.2.1 Level of Quality Control Effort

To assess whether QA objectives have been achieved, analyses of specific field and laboratory QC samples will be required. These QC samples include field duplicates, laboratory method blanks, laboratory control samples, laboratory duplicates, rinsate blanks, field blanks, and matrix spike/matrix spike duplicate (MS/MSD) samples will be analyzed to assess the quality of the data resulting from the sampling program.

Field duplicate samples will be submitted for analysis along with rinsate blanks to provide a means to assess the quality of the data resulting from the field sampling program. Criteria and evaluation of blank determinations are provided in Section 5.8.3. Field duplicate samples are analyzed to determine sample homogeneity and sampling methodology reproducibility.

Laboratory method blanks and laboratory control samples are used to determine the accuracy and precision of the analytical method implemented by the laboratory. Matrix spikes provide information about the effect of the sample matrix on the measurement methodology. Laboratory sample duplicates and MSDs assist in determining the analytical reproducibility and precision of the analysis for the samples of interest.

The general level of QC effort will be at least one field duplicate for every ten investigative samples. MS/MSD samples are investigative samples. Soil MS/MSD samples require no extra volume.

Aqueous MS/MSD samples must be collected at triple the volume for semi-volatile organic compound (SVOC), pesticide, and metal parameters. One MS/MSD sample will be designated in the field and collected for at least every 20 investigative samples per sample matrix (i.e., groundwater, soil).

The goal is to provide a level of QC effort in conformance with the protocols of the EPA SW-846 (EPA 1993b). The level of QC effort for testing and analysis of parameters beyond the scope of the

SW-846 protocols will conform to accepted methods, such as American Society for Testing and Materials (ASTM) protocols, and National Institute for Occupational Safety and Health (NIOSH) protocols.

The QC effort for in-field measurements including temperature, conductivity, pH, organic vapor concentrations, oxidation-reduction potential, and dissolved oxygen level will include daily calibration of instruments using traceable standards and documented instrument manufacturer procedures. Field instruments and their method of calibration are discussed further in Section 5.7 of this QAPP.

5.3.2.2 Accuracy, Precision, and Sensitivity of Analysis

The fundamental QA objectives for accuracy, precision, and sensitivity of laboratory analytical data are the QC acceptance criteria of the analytical protocols. The accuracy and precision required for the specified analytical parameters are incorporated in Tables 5.2 and 5.3 and are consistent with the analytical protocols. The sensitivities, or project target detection limits, required for the analyses are identified in Tables 5.4 and 5.5. Accuracy quantifies the nearness of a result, or the mean of a set of results, to the true or accepted value. Precision quantifies the degree of reproducibility of a set of replicate results, or the agreement of repeat observations made under the same conditions.

Accuracy and precision goals for field measurements of pH, conductivity, temperature, oxidationreduction potential, and dissolved oxygen concentration are listed in Table 5.3. Laboratory acceptance criteria, established through the use of historical data, are presented in the laboratory QAPs.

Analytical accuracy is expressed as the percent recovery of an analyte that has been added to a blank sample or environmental sample at a known concentration before analysis. Accuracy will be determined in the laboratory through the use of surrogate spikes, MS analyses, laboratory control sample (LCS) analyses, and/or blank spike analyses. The percent recoveries for specific target analytes will be calculated and used as an indication of the accuracy of the analyses performed. Project accuracy control limits are presented in Table 5.6 and 5.7.

Precision will be determined through the use of spike analyses conducted on duplicate pairs of spiked environmental samples (MS/MSD) or comparison of positive duplicate pair responses. The relative percent difference (RPD) between the two results will be calculated and used as an indication of the precision of the analyses performed. Project precision limits are presented in Table 5.6.

Sample collection precision will be measured by the analyses of field duplicates. Precision will be reported as the RPD for two measurements.

5.3.2.3 Completeness, Representativeness, and Comparability

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount. It is expected that laboratories will provide data meeting QC acceptance criteria for all samples tested. Overall project completeness goals are identified in Table 5.2.

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an

environmental condition. Representativeness is a qualitative parameter that depends upon the proper design of the sampling program and proper laboratory protocol. The sampling network was designed to provide data representative of site conditions. During development of this plan, consideration was given to site history, past waste disposal practices, existing analytical data, physical setting and processes, and constraints inherent to this investigation. The rationale of the sampling design is discussed in detail in the FSP (Section 4 of the Work Plan). Representativeness will be satisfied by ensuring that the Work Plan is followed, proper sampling techniques are used, proper analytical procedures are followed, and holding times of the samples are not exceeded. Representativeness will be determined by assessing the combined aspects of the QA program, QC measures, and data evaluations.

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends upon the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data are expected to provide comparable data. These new analytical data, however, may not be directly comparable to existing data because of differences in procedures and QA objectives.

5.4 SAMPLING LOCATIONS AND PROCEDURES

It is anticipated that investigations performed at Scotts will produce soil, sediment, surface water, groundwater, and investigation-derived waste (IDW) samples for analyses. Additional samples will be collected to complete field QC duplicate, MS/MSD, field blank, and QA split sample analyses. Specific numbers of samples (including parameters and methods) are incorporated into Table 5.1. Investigation samples will require SVOC, pesticide, metal, herbicide, total organic carbon, and other general determinations, as represented in Tables 5.2 and 5.3. Soil samples will also be collected in accordance with the field sampling plan for soil characterization by analyzing for the following geotechnical parameters: bulk density, porosity, action exchange capacity, total organic content, pH, particle size distribution and moisture content. Sampling procedures for the various media under investigation are discussed in the FSP (Section 4).

Identification of the primary field equipment and supporting materials to be used for these investigations is presented in the FSP (Section 4) and in the Standard Operating Procedures (SOPs) in Appendix 4A. Several different types of field measurements will be performed during these investigations. Soil field measurements will determine soil classification and characteristics. Groundwater field measurements will determine groundwater characteristics (pH, specific conductance, dissolved oxygen, oxidation-reduction potential, and temperature), and static groundwater levels. A description of the field instruments and associated calibration requirements and performance checks to be used for field measurements is presented in the FSP and Section 5.7 of this QAPP.

The locations of the sampling stations and sample media to be collected during these investigations, and the rationales for the selection of these stations, are presented in the FSP of the Work Plan.

5.4.1 General Information And Definitions

QC Samples

These samples are analyzed for the purpose of assessing the quality of the sampling effort and of the reported analytical data. QC samples to be used for this project are duplicates, MS/MSDs, and equipment rinsate blank samples.

Field Duplicate Samples

These samples are collected concurrently with the primary environmental samples and equally represent the medium at a given time and location. Duplicate samples will be collected from each media addressed by this project and be submitted to the contractor laboratory for analysis. Field duplicates will be sampled an analyzed at a rate of one per ten environmental samples.

Trip Blank Samples

These samples consist of containers of organic-free reagent water that are kept with the field sample containers from the time they leave the laboratory until the time they are returned for VOC analysis. The purpose of trip blanks is to determine whether samples are being contaminated during transit or sample collection. For this project, no VOCs are to be collected and no trip blanks will be required.

Equipment Rinsate

These samples will be taken from the water rinsate collected from equipment decontamination activities. Decontamination water will be collected in drums or other containers. Samples will be taken from the container and submitted for analysis with the primary samples. Equipment rinsate samples will be collected after decontamination at each Area of Concern.

5.4.2 Sample Containers, Preservation Procedures, And Holding Times

Sample containers, chemical preservation techniques, and holding times for soils and waters collected during these investigations are described in Tables 5.8 and 5.9. The specific number of containers required for this study will be estimated and supplied by the analytical facilities. Additional sample volumes will be collected and provided, when necessary, for performing associated QC (laboratory duplicates and MS/MSD field duplicates).

All sample containers will be provided by the analytical support laboratories, which will also provide the required types and volumes of preservatives with containers as they are delivered to SAIC. Temperature preservation will be maintained at 4° ($\pm 2^{\circ}$ C) immediately after collection and will be maintained at this temperature until the samples are analyzed. In the event that sample integrity, such as holding times, cooler temperatures, etc., is compromised, resampling will occur as directed by Scotts' Project Manager.

5.4.3 Field Documentation

5.4.3.1 Field Logbooks

Sufficient information will be recorded in the logbooks to permit reconstruction of all direct push technology (DPT) and other sampling activities conducted. Information recorded on other project documents will not be repeated in the logbooks except in summary form where determined necessary. All field logbooks will be kept in the possession of field personnel responsible for completing the logbooks, or in a secure place when not being used during field work. Upon completion of the field activities, all logbooks will be submitted to Scotts to become part of the final project file. Refer to the Field Sampling Plan.

5.4.3.2 Sample Numbering System

A unique sample numbering scheme will be used to identify each sample designated for laboratory analysis. The purpose of this numbering scheme is to provide a tracking system for the retrieval of analytical and field data on each sample. Sample identification numbers will be placed on all sample labels or tags, field data sheets and/or logbooks, COC records, and all other applicable documentation used during the project. A listing of all sample identification numbers will be maintained in the field logbook. The sample numbers to be used for the project are discussed in Sections 4 and 7 of the Work Plan.

5.4.3.3 Documentation Procedures

The tracking procedure to be used for documentation of all samples collected during the project will involve the steps outlined in the Work Plan.

5.4.4 Field Variance System

Procedures cannot fully encompass all conditions encountered during a field investigation. Variances from the operating procedures, field sampling plan, and/or safety and health plan may occur. All variances that occur during the field investigation will be documented on a field change order (FCO) form or a NCR and will be noted in the appropriate field logbooks. If a variance is anticipated (e.g., because of a change in the field instrumentation), the applicable procedure will be modified and the change noted in the field logbooks. Field changes and corrective actions are outlined in Section 4 of the Work Plan and in Section 5.10 of this QAPP.

5.5 SAMPLE CUSTODY AND HOLDING TIMES

It is the policy of SAIC and will be the intent of this investigation to follow EPA policy regarding sample custody and chain-of-custody (COC) protocols as described in *NEIC Policies and Procedures* (EPA 1985). This custody is in three parts: sample collection, laboratory analysis, and final evidence files. Final evidence files, including originals of laboratory reports and electronic files, are maintained under document control in a secure area. A sample or evidence file is under your custody when it is:

- in your possession;
- in your view, after being in your possession;
- in your possession and you place them in a secured location; or
- in a designated secure area.

5.5.1 Sample Documentation

The sample packaging and shipment procedures summarized below will ensure that samples will arrive at the laboratory with the COC intact. The protocol for specific sample numbering using case numbers and traffic report numbers (if applicable) and other sample designations are included in the FSP.

5.5.1.1 Field Procedures

The field sampler is responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples. Each sample container will be labeled with a sample number, date and time of collection, sampler, and sampling location. Sample labels are to be completed for each sample. The SAIC Project Manager will review all field activities to determine whether proper custody procedures were followed during the field work and to decide if additional samples are required.

5.5.1.2 Field Logbooks/Documentation

Samples will be collected following the sampling SOPs documented in the FSP (Section 4) and in Appendix 4A. When a sample is collected or a measurement is made, a detailed description of the location shall be recorded. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume, and number of containers. A sample identification number will be assigned before sample collection. Field duplicate samples, which will receive an entirely separate sample identification number, will be noted under sample description. Equipment employed to make field measurement will be identified along with their calibration dates.

Field documentation will be maintained throughout the project in various types of documents and formats including the site logbook, field logbooks, sample labels, sample tags, chain-of-custody forms, and field data sheets. The general guidelines for maintaining field documentation listed below will be followed.

- All entries will be written clearly and legibly using indelible black ink.
- Corrections will be made by striking through the error with a single line that does not obliterate the original entry. Corrections will be dated and initialed.
- Dates and times will be recorded using the format "mm/dd/yy" for the date and the military (i.e., 24-hour) clock to record the time.
- Zeroes will be recorded with a slash (/) to distinguish them from letter O's.

- Blank lines are prohibited. Information should be recorded on each line or the line should be lined out, initialed, and dated.
- No documents will be altered, destroyed, or discarded even if they are illegible or contain inaccuracies that require correction.
- All information blocks on field data forms will be completed, or a line will be drawn through the unused section and the area will be dated and initialed.
- Unused logbook pages will be marked with a diagonal line drawn from corner to corner, and a signature and date will be placed on the line.
- Security of all logbooks will be maintained by storing them in a secured area when not in use.

5.5.1.3 Field Logbooks

Field team personnel will use bound field logbooks having sequentially numbered pages for maintaining field records and documenting any information pertinent to field activities. Field forms will be sequentially numbered or otherwise controlled. Information identified in the field logbook will be obtained from site exploration, observation, and sampling activities, and the data will be recorded by a designated field team member.

An integral component of QA/QC for the field activities will be to maintain accurate and complete field records and collect appropriate field data forms. The primary purpose of the logbook is to document each day's field activities; the personnel on each sampling team; and any administrative occurrences, conditions, or activities that may have affected the fieldwork or data quality of any environmental samples for any given day. The level of detail of the information recorded in the field logbook should be such that an accurate reconstruction of the field events can be created from the logbook. The project name, logbook number, client, contract number, task number, document control number, activity or site name, and start and finish dates will be listed on the logbook's front cover. Important phone numbers, radio call numbers, emergency contacts, and a return address should be recorded on the inside of the front cover.

5.5.1.4 Field Data Sheets

Field data sheets will be maintained, as appropriate, for the following types of data:

- water level measurements,
- soil DPT logs,
- well development logs,
- well purging logs,
- groundwater sampling logs,
- chain-of-custody, and
- instrument calibration logs.

Data to be recorded will include such information as the location, sampling depth, sampling station, and applicable sample analysis to be conducted. Field-generated data forms will be prepared, if

necessary, based on the appropriate requirements. The field logbook should cross-reference the field data sheet(s).

5.5.1.5 Transfer of Custody and Shipment Procedures

Samples are accompanied by a properly completed COC form. The sample numbers and locations will be listed on the COC form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record will document transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage area. An example of the COC form to be used for these investigations is presented in the FSP.

All shipments will be accompanied by the COC record identifying the contents. The original record will accompany the shipment, and copies will be retained by the sampler for return to project management and the project file. Whenever co-located or split samples are collected for comparison analysis, a separate COC is prepared for those samples and marked to indicate with whom the samples are being split.

All shipments will be in compliance with applicable U.S. Department of Transportation (DOT) regulations for environmental samples. SAIC will ship samples for weekend delivery when the laboratory has assured SAIC that personnel will be present to receive and effect any necessary processing within the analytical holding times.

5.5.2 Laboratory COC Procedures

Custody procedures along with the holding time and sample preservative requirements for samples will be described in laboratory QA Plans. These documents will identify the laboratory custody procedures for sample receipt and log-in, sample storage, tracking during sample preparation and analysis, and laboratory storage of data.

5.5.2.1 Cooler Receipt Checklist

The condition of shipping coolers and enclosed sample containers will be documented upon receipt at the analytical laboratory. Any problems encountered upon receipt are to reported to the laboratory coordinator and/or field manager for possible impact to the project. The documentation of sample receipt by the laboratory will be transmitted with the final analytical results from the laboratory.

5.5.2.2 Letter of Receipt

The laboratory will confirm sample receipt and log-in information through transmission of a Letterof-Receipt (LOR) to SAIC. This will include returning a copy of the completed COC, a documentation of the cooler receipt, and confirmation of the analytical log-in indicating laboratory sample and sample delivery group numbers.

5.5.3 Final Evidence Files Custody Procedures

SAIC is the custodian of the evidence file and will maintain the contents of evidence files for this investigation, including all relevant records, reports, logs, field notebooks, pictures, subcontractor

reports, correspondence, laboratory logbooks, and COC forms. The evidence file will be stored in a secure, limited-access area and under custody of the SAIC Project Manager.

Analytical laboratories will retain all original raw data information (both hard copy and electronic) in a secure, limited-access area and under custody of the Laboratory Project Manager for 7 years as specified in the contract.

5.6 ANALYTICAL PROCEDURES

All samples collected during the investigation activities will be analyzed by laboratories reviewed and validated by the SAIC QA/QC Officer. Each laboratory supporting this work shall provide statements of qualifications including organizational structure, QA Manual, and standard operating procedures (SOPs).

5.6.1 Laboratory Analysis

Samples collected during the project will be analyzed by EPA SW-846 methods. Laboratory standard operating procedures are based on the methods as published by the EPA in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods SW846*, Third Edition (November 1986; Revision 1, July 1992; Revision 2, November 1992; and Updates 1, 2, and 3). Analytical parameters, methods, and quantitation or detection limits are listed in Tables 5.4 and 5.5.

Principal laboratory facilities will not subcontract or transfer any portion of this work to another facility, unless expressly permitted to do so in writing by SAIC and Scotts Project Manager.

If contaminant concentrations are high, or for matrices other than normal waters and soils, analytical protocols may be inadequate. In these cases, sample analysis may require modifications to defined methodology. Any proposed changes to analytical methods specified require written approval from SAIC and Scotts. All analytical method variations will be identified in investigation-specific addenda. These may be submitted for regulatory review and approval when directed by Scotts Project Manager.

These SOPs must be adapted from and reference standard EPA SW-846 methods and thereby specify:

- procedures for sample preparation,
- instrument start-up and performance check,
- procedures to establish the actual and required detection limits for each parameter,
- initial and continuing calibration check requirements,
- specific methods for each sample matrix type, and
- required analyses and QC requirements.

5.6.2 Field Screening Analytical Protocols

Procedures for field measurement of pH, specific conductivity, temperature, oxidation-reduction potential, and dissolved oxygen are discussed in Section 5.7 of this QAPP. Tabulation of the methodologies appears in Tables 5.2 and 5.3.

5.7 CALIBRATION PROCEDURES AND FREQUENCY

This section describes procedures for maintaining the accuracy of all the instruments and measuring equipment that are used for conducting field tests and laboratory analyses. These instruments and equipment shall be calibrated before each use or on a scheduled, periodic basis according to EPA requirements, laboratory SOPs or manufacturer instructions.

5.7.1 Field Instruments/Equipment

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. All field instruments for this purpose will have unique identifiers and each instrument will be logged in the Measuring and Testing Equipment (M&TE) Log Book before use in the field. The site safety and health officer or his/her designate will be responsible for performing and documenting daily calibration/checkout records for instruments used in the field.

Equipment to be used during the field sampling will be examined to certify that it is in operating condition. This will include checking the manufacturer's operating manual and instructions for each instrument to ensure that all maintenance requirements are being observed. Field notes from previous sampling trips will be reviewed so that the notation on any prior equipment problems will not be overlooked, and all necessary repairs to equipment will be carried out. Spare parts or duplication of equipment will be available to support the sampling effort.

Calibration of field instruments is governed by the specific SOP for the applicable field analysis method, and it will be performed at the intervals specified in the SOP. If no SOP is available, calibration of field instruments will be performed at intervals specified by the manufacturer or more frequently as conditions dictate. Calibration procedures and frequency will be recorded in a field logbook.

Field instruments may include a pH meter, temperature probe, specific conductivity meter, oxidationreduction potential meter, and a dissolved oxygen meter. If an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be returned to the manufacturer for service and a back-up instrument will be calibrated and used in its place. Field instrument uses, detection levels, and calibration are summarized in Table 5.10.

Detailed instructions on the proper calibration and use of each field instrument follow the guidelines established by the manufacturer. The technical procedures for each instrument used on this project include the manufacturer's instructions detailing the proper use and calibration of each instrument.

5.7.1.1 pH Meter Calibration

The pH meter will be calibrated according to the manufacturer's instructions using traceable standard buffer solutions before work in the field. Calibration will follow these steps:

Temperature of sample and buffer should be the same.

- Connect pH electrode into pH meter and turn on pH meter.
- Adjust temperature setting based on the temperature of buffer; place electrode in first buffer solution.
- After reading has stabilized, adjust ACALIB® knob to display correct value.
- Repeat procedure for second buffer solution.
- Place pH electrode in the sample and record the pH as displayed.
- Remove pH electrode from sample and rinse off with distilled water.
- Recalibrate the pH meter every time it is turned off and turned back on, or if it starts giving erratic results.

Before use in the field, calibration of the pH meter will be checked against two standard buffer solutions. Calibration procedures, lot numbers of buffer solutions, and other pertinent calibration or checkout information will be recorded in the M&TE Log Book for the project. The calibrations performed, standard used, and sample pH values are to be recorded in the field notebook.

Appropriate new batteries will be purchased and kept with the meters to facilitate immediate replacement in the field as necessary.

5.7.1.2 Temperature Calibration

Temperature measurements are carried out using a temperature probe. Mercury thermometers must be inspected before use to ensure that there is no mercury separation. Thermometers should be rechecked in the field before and after each use to see if the readings are logical and the mercury is still intact. All temperature probes should be checked biannually for calibration by immersing them in a bath of known temperature until equilibrium is reached. Temperature probes should be replaced if found to have more than 10 percent error. The reference thermometer used for bath calibration should be National Institute of Standards and Testing (NIST) traceable. Temperatures will be recorded in the M&TE Log Book, the Sample Log Book, or the Cooler Log Book, as appropriate.

5.7.1.3 Conductivity Meter Calibration

The conductivity cells of the specific conductivity meter will be cleaned according to manufacturer's recommendations and specifications and checked against known conductivity standard solutions before each sampling event. The instrument will be checked daily with NIST-traceable standard

solutions. If the instrument is more than 10 percent out of calibration when compared with standard solutions, the instrument will be recalibrated. If this cannot be done in the field, the instrument will be returned to the manufacturer or supplier for recalibration and a back-up instrument will be used in its place. Daily calibration readings and other relevant information will be recorded daily in the M&TE Log Book.

Daily checks should be as follows:

- Fill a sample cup with the conductivity calibration standard solution.
- Set temperature knob for temperature of standard solution.
- Turn to appropriate scale and set the instrument for the value of calibration standard.
- Rinse out the cup with distilled water.

5.7.2 Laboratory Instruments

Calibration of laboratory equipment will be based on approved written procedures. Records of calibration, repairs, or replacement will be filed and maintained by laboratory personnel performing QC activities. These records will be filed at the location where the work is performed and will be subject to QA audit. Procedures and records of calibration will follow SAIC-reviewed laboratory-specific QA Plans.

In all cases where analyses are conducted according to the SW 846 protocols, the calibration procedures and frequencies specified in the applicable SW 846 methods will be followed exactly. For analyses governed by SOPs, refer to the appropriate SOP for the required calibration procedures and frequencies.

Records of calibration will be kept as follows:

- If possible, each instrument will have a record of calibration with an assigned record number.
- A label will be affixed to each instrument showing identification numbers, manufacturer, model numbers, date of last calibration, signature of calibrating analyst, and due date of next calibration. Reports and compensation or correction figures will be maintained with instrument.
- A written step-wise calibration procedure will be available for each piece of test and measurement equipment.
- Any instrument that is not calibrated to the manufacturer's specification will display a warning tag to alert the analyst that the device carries only a Limited Calibration.

5.8 INTERNAL QUALITY CONTROL CHECKS

5.8.1 Field Sample Collection

The assessment of field sampling precision and accuracy is made by collecting field duplicates, MS/MSDs, and blanks in accordance with the procedures described in the project Work Plan.

5.8.2 Field Measurement

QC procedures for most field measurements (i.e., pH, conductivity, temperature, dissolved oxygen, etc.) are limited to checking the reproducibility of the measurement by obtaining multiple readings on a single sample or standard and by calibrating the instruments. Refer to Section 5.7 of this QAPP for more detail regarding these measurements.

5.8.3 Laboratory Analysis

Analytical QC procedures for these investigations are specified in the individual method descriptions. These specifications include the types of QC checks normally required; method blanks, LCS, MS, MSD, calibration standards, internal standards, surrogate standards, tracer standards, calibration check standards, and laboratory duplicate analysis. Calibration compounds and concentrations to be used and the method of QC acceptance criteria for these parameters have been identified.

To ensure the production of analytical data of known and documented quality, laboratories associated with these investigations will implement all method QA and QC checks.

5.8.3.1 QA Program

All subcontracted analytical laboratories will have a written QA program that provides rules and guidelines to ensure the reliability and validity of work conducted at the laboratory. Compliance with the QA program is coordinated and monitored by the laboratory's QA department, which is independent of the operating departments. For these investigations selected support laboratory Quality Assurance Plans will be referenced and implemented in their entirety.

The stated objectives of the laboratory QA program are to:

- properly collect, preserve, and store all samples;
- maintain adequate custody records from sample collection through reporting and archiving of results;
- use properly trained analysts to analyze all samples by approved methods within holding times;
- produce defensible data with associated documentation to show that each system was calibrated and operating within precision and accuracy control limits;
- accurately calculate, check, report, and archive all data using the Laboratory Information Management System; and
- document all the above activities so that all data can be independently validated.

All laboratory procedures are documented in writing as SOPs, which are edited and controlled by the QA department. Internal QC measures for analysis will be conducted with their SOPs and the individual method requirements specified.

5.8.3.2 QC Checks

Implementation of QC procedures during sample collection, analysis, and reporting ensures that the data obtained are consistent with its intended use. Both field QC and laboratory QC checks are performed throughout the work effort to generate data confidence. Analytical QC measures are used to determine if the analytical process is in control, as well as to determine the sample matrix effects on the data being generated.

Specifications include the types of QC required (duplicates, sample spikes, surrogate spikes, reference samples, controls, blanks, etc.), the frequency for implementation of each QC measure, compounds to be used for sample spikes and surrogate spikes, and the acceptance criteria for this QC.

Laboratories will provide documentation in each data package that both initial and ongoing instrument and analytical QC functions have been met. Any non-conforming analysis will be reanalyzed by the laboratory, if sufficient sample volume is available. It is expected that sufficient sample volumes will be collected to provide for reanalyzes, if required.

5.8.3.2.1 Analytical Laboratory Quality Control

5.8.3.2.1.1 Method Blanks

A method blank is a sample of a noncontaminated substance of the matrix of interest (usually distilled/de-ionized water or silica sand) that is then subjected to all of the sample preparation (digestion, distillation, extraction) and analytical methodology applied to the samples. The purpose of the method blank is to check for contamination from within the laboratory that might be introduced during sample preparation and analysis that would adversely affect analytical results. A method blank must be analyzed with each analytical sample batch.

Analytical sensitivity goals are identified in Table 5.4 as practical quantitation limits. Method blank levels should be below these levels for all analytes, corrective actions (CA) criteria are established at 2x these levels.

5.8.3.2.1.2 Laboratory Control Samples

The Laboratory Control Samples (LCS) contains known concentrations of analytes representative of the contaminants to be determined and is carried through the entire preparation and analysis process. Commercially available LCSs or those from EPA may be used. LCS standards that are prepared in-house must be made from a source independent of that of the calibration standards. Each LCS analyte must be plotted on a control chart. The primary purpose of the LCS is to establish and monitor the laboratory's analytical process control. An LCS must be analyzed with each analytical sample batch.

5.8.3.2.2 Matrix And Sample-Specific Quality Control

Matrix and sample-specific quality control is conducted by evaluating laboratory duplicates and surrogate spike results. Surrogate spikes and laboratory duplicates are carried through the entire

preparation and analysis process. The primary purpose of the matrix and sample-specific QC is to establish and monitor the laboratory's analytical process control and to evaluate for interferences.

5.8.3.2.2.1 Laboratory Duplicates

Laboratory duplicates where applicable, are separate aliquots of a single sample that are prepared and analyzed in the same batch. This duplicate sample should not be a method blank, trip blank, or field blank. The primary purpose of the laboratory duplicate is to check the precision of the laboratory analyst, the sample preparation methodology, and the analytical methodology. If there are significant differences between the duplicates, the affected analytical results will be reexamined. One in 20 samples will be a laboratory duplicate, with fractions rounded to the next whole number.

5.8.3.2.2.2 Surrogate Spikes

A surrogate spike is prepared by adding pure compounds to a sample before extraction. The compounds in the surrogate spike should be of a similar type to that being assayed in the sample. The purpose of a surrogate spike is to determine the efficiency of recovery of analytes in the sample preparation and analysis. The percent of recovery of the surrogate spike is then used to gauge the accuracy of the analytical method, with respect to the matrix, for that sample.

5.8.3.2.2.3 Matrix Spikes And Matrix Spike Duplicates

An MS is an aliquot of a sample spiked with known quantities of analytes and subjected to the entire analytical procedure. It is used to indicate the appropriateness of the method for the matrix by measuring recovery or accuracy. An MSD is a second aliquot of the same sample with known quantities of compounds added. The purpose of the MSD, when compared to the MS, is to determine method precision. MSs and MSDs are performed per 20 samples on analytic batch of similar matrix.

5.8.3.2.2.4 Method-Specific QC

The laboratory must follow specific quality processes as defined by the method. These will include measures such as calibration verification samples, instrument blank analysis, internal standards implementation, tracer analysis, method of standard additions utilization, serial dilution analysis, post-digestion spike analysis, chemical carrier evaluation, etc.

5.9 CALCULATION OF DATA QUALITY INDICATORS

5.9.1 Field Measurements Data

Field data will be assessed by the site Field Manager. He/she will review the field results for compliance with the established QC criteria that are specified in the QAPP and Work Plan. Accuracy of the field measurements will be assessed using daily instrument calibration, calibration check, and analysis of blanks. Precision will be assessed on the basis of reproducibility by multiple readings of a single sample.

Field data completeness will be calculated using Equations (1a) and (1b).

Sample Collection (1a):

Completeness= Number of SamplePointsSampled Number of SamplePointsPlanned ×100%, (1a) Field Measurements (1b):

$$Completeness = \frac{Number of Valid Field Measurements Made}{Number of Field Measurements Planned} \times 100\% ,$$
 (1b)

5.9.2 Laboratory Data

Laboratory results will be assessed for compliance with required precision, accuracy, completeness, and sensitivity as follows.

5.9.2.1 Precision

The precision of the laboratory analytical process will be determined through evaluation of LCS analyses. The standard deviation of these measurements over time will provide confidence that implementation of the analytical protocols was consistent and acceptable. These measurements will establish the precision of the laboratory analytical process.

Investigative sample matrix precision will be assessed by comparing the analytical results between MS/MSD for organic analysis and laboratory duplicate analyses for inorganic analysis. The RPD will be calculated for each pair of duplicate analysis using Equation (2) and produce an absolute value for RPD. This precision measurement will include variables associated with the analytical process, influences related to sample matrix interferences, and sample heterogeneity.

$$RPD = \frac{\frac{S-D}{(S+D)}}{2} \times 100 ,$$

(2)

where

S = first sample value (original or MS value),

D = second sample value (duplicate or MSD value).

5.9.2.2 Accuracy

The accuracy of the laboratory analytical measurement process will be determined by comparing the percent recoveries for the LCS compounds to their documented true value.

Investigative sample accuracy will be assessed for compliance with the established QC criteria that are described in Section 3.0 of this QAPP using the analytical results of method blanks, reagent/preparation blank, MS/MSD samples, field blank, rinsate blanks and trip blanks. The percent recovery (%R) of MS samples will be calculated using Equation (3). This accuracy will include

variables associated with the analytical process, influences related to sample matrix interferences, and sample heterogeneity.

$$\%R = \frac{A-B}{C} \times 100 \quad , \tag{3}$$

where

A = the analyte concentration determined experimentally from the spiked sample,

B = the background level determined by a separate analysis of the unspiked sample,

C = the amount of the spike added.

5.9.2.3 Completeness

Data completeness of laboratory analyses will be assessed for compliance with the amount of data required for decision making. The completeness is calculated using Equation (4).

$$Completeness = \frac{Number of Valid Laboratory Measurements Made}{Number of Laboratory Measurements Planned} \times 100\% ,$$
(4)

5.9.2.4 Sensitivity

Achieving method detection limits depends on sample preparation techniques, instrumental sensitivity, and matrix effects. Therefore, it is important to determine actual method detection limits (MDLs) through the procedures outlined in 40 *CFR* 136, Appendix C. MDLs should be established for each major matrix under investigation (i.e., water, soil) through multiple determinations, leading to a statistical evaluation of the MDL.

It is important to monitor instrument sensitivity through calibration blanks and low concentration standards to ensure consistent instrument performance. It is also important to monitor the analytical method sensitivity, at or near the PQL, through analysis of method blanks, calibration check samples, and LCSs, etc.

5.9.3 Project Completeness

Project completeness will be determined by evaluating the planned versus actual data. Consideration will be given for project changes and alterations during implementation. All data not qualified as rejected by the review, verification, validation, or assessment processes will be considered valid. Overall, the project completeness will be assessed relative to media, analyte, and area of investigation. Completeness objectives are listed in Table 5.2 (soil) and Table 5.3 (water).

5.9.4 Representativeness/Comparability

Representativeness expresses the degree to which data accurately reflect the analyte or parameter of interest for the environmental media examined at the site. It is a qualitative term most concerned with the proper design of the sampling program. Factors that affect the representativeness of analytical data include appropriate sample population definitions, proper sample collection and

preservation techniques, analytical holding times, use of standard analytical methods, and determination of matrix or analyte interferences. Sample collection, preservation, analytical holding time, analytical method application, and matrix interferences will be evaluated by reviewing project documentation and QC analyses.

Comparability, like representativeness, is a qualitative term relative to a project data set as an individual. These investigations will employ narrowly defined sampling methodologies, site audits/surveillance, use of standard sampling devices, uniform training, documentation of sampling, standard analytical protocols/procedures, QC checks with standard control limits, and universally accepted data reporting units to ensure comparability to other data sets. Through proper implementation and documentation of these standard practices, the project will establish confidence that data will be comparable to other project and programmatic information.

5.10 CORRECTIVE ACTIONS

Corrective actions may be required for two major types of problems: analytical/equipment problems and noncompliance with project requirements. Analytical and equipment problems may surface during sampling, sample handling, sample preparation, laboratory instrumental analysis, and data review.

Noncompliance with project requirements and analytical/equipment problems will be documented through a formal corrective action program at the time the problem is identified. The person identifying the problem is responsible for notifying the SAIC Project Manager and the Scotts Project Manager. When the problem is analytical in nature, information on these problems will be promptly communicated to the SAIC Analytical Laboratory Coordinator. Implementation of corrective action will be confirmed in writing.

Any nonconformance with the established QA/QC procedures in the QAPP or SAP will be identified and corrected in accordance with the QAPP. The SAIC Project Manager or his/her designee will issue an NCR (or ADNCR for Analytical Data Packages) for each nonconforming condition.

Corrective actions will be implemented and documented in the field record book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are deemed insufficient, work may be stopped through a stop-work order issued by the SAIC Project Manager or the Scotts Project Manager.

5.10.1 Sample Collection/Field Measurements

Technical staff and project personnel will be responsible for reporting all suspected technical and QA nonconformances or suspected deficiencies of any activity or issued document by reporting the situation to the SAIC Project Manager or his/her designee. The manager will be responsible for assessing the suspected problems in consultation with the SAIC Project QA Manager to make a decision based on the potential for the situation to impact the quality of the data. When it is determined that the situation warrants a reportable nonconformance and corrective action, then an NCR will be initiated by the manager.

The manager will be responsible for ensuring that corrective actions for nonconformances are initiated by:

- evaluating all reported nonconformances,
- controlling additional work on nonconforming items,
- determining disposition or action to be taken,
- maintaining a log of nonconformances,
- reviewing NCRs and corrective actions taken, and
- ensuring that NCRs are included in the final site documentation project files.

If appropriate, the SAIC Project Manager will ensure that no additional work dependent on the nonconforming activity is performed until the corrective actions are completed. Corrective action for field measurements may include:

- repeating the measurement to check the error,
- checking for all proper adjustments for ambient conditions such as temperature,
- checking the batteries,
- re-calibrating equipment,
- checking the calibration,
- modifying the analytical method including documentation and notification (i.e., standard additions),
- replacing the instrument or measurement devices, and
- stopping work (if necessary).

The SAIC Project Manager or his/her designee is responsible for all site activities. In this role, he/she may at times be required to adjust the site activities to accommodate site-specific needs. When it becomes necessary to modify a program, the responsible person notifies the SAIC Project Manager of the anticipated change and implements the necessary changes after obtaining the approval of the SAIC Project Manager and the Scotts Project Manager. All changes in the program will be documented on the FCO that will be signed by the initiators and the SAIC Project Manager. The FCO for each document will be numbered serially as required. The FCO shall be attached to the file copy of the affected document. The SAIC Project Manager must approve the change in writing or verbally before field implementation. If unacceptable, the action taken during the period of deviation will be evaluated in order to determine the significance of any departure from established program practices and action taken.

The SAIC Project Manager for the site is responsible for the controlling, tracking, and implementation of the identified changes. Reports on all changes will be distributed to all affected parties, including the Scotts Project Manager. Scotts will be notified whenever project changes in the field are made.

5.10.2 Laboratory Analyses

The contract laboratory QA plan must provide systematic procedures to identify out-of-control situations and corrective actions. Corrective actions shall be implemented to resolve problems and restore malfunctioning analytical systems. Laboratory personnel have received QA training and are aware that corrective actions are necessary when:

- QC data are outside warning or control windows for precision and accuracy.
- Blanks contain target analytes above acceptable levels and must be investigated.
- Undesirable trends are detected in spike recoveries or RPD between duplicates.
- There are unusual changes in detection limits.
- Deficiencies are detected by internal audits, external audits, or from performance evaluation samples results.
- Inquiries concerning data quality are received.

Corrective action procedures are often handled at the bench level by the analyst who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike and calibration mixes, instrument sensitivity, and so on. If the problem persists or cannot be identified, the matter is referred to the Laboratory Supervisor, Manager, and/or QA Department for further investigation. Once resolved, full documentation of the corrective action procedure is filed with project records and the QA Department, and the information is summarized within case narratives. Corrective actions may include:

- re-analyzing the samples, if holding time criteria permit;
- evaluating blank contaminant sources, elimination of these sources, and reanalysis;
- modifying the analytical method (i.e., standard additions) with appropriate notification and documentation;
- resampling and analyzing;
- evaluating and amending sampling procedures; or
- accepting data and acknowledging the level of uncertainty.

If resampling is deemed necessary due to laboratory problems, the SAIC Project Manager will identify the necessary cost recovery approach to implement the additional sampling effort.

The following corrective action procedures will be required:

- Problems noted during sample receipt will be documented in the appropriate laboratory LOR. SAIC and Scotts will be contacted immediately to determine problem resolution. All corrective actions will be thoroughly documented.
- When sample extraction/digestion or analytical holding times are not within method required specifications, SAIC and Scotts will be notified immediately to determine problem resolution. All corrective actions will be thoroughly documented.
- All initial and continuing calibration sequences that do not meet method requirements will result in a review of the calibration. When appropriate, re-analysis of the standards or re-analysis of the affected samples back to the previous acceptable calibration check is warranted.
- All appropriate measures will be taken to prepare and clean up samples in an attempt to achieve the practical quantitation limits as stated. When difficulties arise in achieving these limits, the laboratory will notify SAIC and the Scotts to determine problem resolution. All corrective actions will be thoroughly documented.
- Any dilutions impacting the practical quantitation limits will be documented in case narratives along with revised quantitation limits for those analytes affected. Analytes detected above the method detection limits, but below the practical quantitation limits, will be reported as estimated values.
- Failure of method-required QC to meet the requirements specified in this QAPP shall result in review of all affected data. Resulting corrective actions may encompass those identified earlier. SAIC and Scotts will be notified as soon as possible to discuss possible corrective actions, particularly when unusual or difficult sample matrices are encountered.
- When calculation and reporting errors are noted within any given data package, reports will be reissued with applicable corrections. Case narratives will clearly state the reasons for reissuance of reports.

5.11 DATA REDUCTION, VALIDATION, AND REPORTING

5.11.1 Data Reduction

5.11.1.1 Field Measurements And Sample Collection

Raw data from field measurements and sample collection activities will be appropriately recorded in field logbooks. Data to be used in project reports will be reduced and summarized. The methods of data reduction will be documented.

The SAIC Project Manager or his/her designee is responsible for data review of all field-generated data. This includes verifying that all field descriptive data are recorded properly, that all field instrument calibration requirements have been met, that all field QC data have met frequency and criteria goals, and that field data are entered accurately in all logbooks and worksheets.

5.11.1.2 Laboratory Services

Data will be reduced, evaluated, and reported as described in the laboratory QA plan. Data reduction, review, and reporting by the laboratory will be conducted as follows:

The raw data are produced by the analyst who has primary responsibility for the correctness and completeness of the data. All data will be generated and reduced following the QAPP defined methods and implementing laboratory SOP protocols.

Level 1 technical data review is completed relative to an established set of guidelines by a peer analyst. The review shall ensure the completeness and correctness of the data while assuring all method QC measures have been implemented and were within appropriate criteria.

Level 2 technical review is completed by the area supervisor or data review specialist. This reviews the data for attainment of QC criteria as outlined in the established methods and for overall reasonableness. It will ensure all calibration and QC data are in compliance and check at least 10 percent of the data calculations. This review shall document that the data package is complete and ready for reporting and archival.

Upon acceptance of the raw data by the area supervisor, the report is generated and sent to the Laboratory Project Manager for Level 3 administrative data review. This review will ensure consistency and compliance with all laboratory instructions, the laboratory QA plan, the project laboratory SOW, and the project QAPP.

The Laboratory Project Manager will complete a thorough review of all reports. Final reports will be generated and signed by the Laboratory Project Manager. Data will then be delivered to SAIC for data validation. The data review process will include identification of any out-of-control data points and data omissions, as well as interactions with the laboratory to correct data deficiencies. Decisions to repeat sample collection and analyses may be made by the Project Manager based on the extent of the deficiencies and their importance in the overall context of the project. The laboratory will provide flagged data to include such items as: (1) concentration below required detection limit, (2) estimated concentration due to poor spike recovery, and (3) concentration of chemical also found in laboratory blank.

Laboratories will prepare and retain full analytical and QC documentation for the project. Such retained documentation will be both hard (paper) copy and electronic storage media (e.g., magnetic tape or CD-ROM) as dictated by the analytical methodologies employed. As needed, laboratories will supply hard copies or electronic files of the retained information.

Laboratories will provide the following information to SAIC in each analytical data package submitted:

• cover sheets listing the samples included in the report and narrative comments describing problems encountered in analysis; tabulated results of inorganic, organic, and miscellaneous parameters identified and quantified;

- analytical results for QC sample spikes, sample duplicates, initial and continuing calibration verifications of standards and blanks, standard procedural blanks, LCSs and other deliverables as identified in Sections 5.11.2; and 5.11.3.
- tabulation of instrument detection limits determined in pure water.

5.11.2 Data Validation

5.11.2.1 Data Validation Approach

A systematic process for data verification and validation will be performed to ensure that the precision and accuracy of the analytical data are adequate for their intended use. The greatest uncertainty in a measurement is often a result of the sampling process and inherent variability in the environmental media rather than the analytical measurement. Therefore, analytical data validation will be performed for primary analytes only to the level necessary to minimize the potential of using false positive or false negative results in the decision-making process (i.e., to ensure accurate identification of detected versus non-detected compounds). This approach is consistent with the DQOs for the project, with the analytical methods, and for determining contaminants of concern and calculating risk.

Definitive data will be reported consistent with the deliverables identified in Section 5.11.3, Tables 5.11 and 5.12. This report content is consistent with what is understood as an EPA Level III deliverable (data forms including laboratory QC and calibration information). This data will then be validated through the review process presented in Section 5.11.2.2. DQOs identified in Section 5.3 and method-specified criteria will be validated. Comprehensive analytical information, such as raw data sheets, will be retained by the subcontract laboratory.

Validation will be accomplished by comparing the contents of the data packages and QA/QC results to requirements contained in the requested analytical methods. The SAIC validation support staff will be responsible for these activities. The protocol for analyte data validation is presented in:

- SAIC Quality Assurance Technical Procedures (SAIC 1995);
- EPA CLP National Functional Guidelines for Organic Data Review (EPA 1994b); and
- EPA CLP National Functional Guidelines for Inorganic Data Review (EPA 1994c).

SAIC data validation staff will conduct a systematic review of 10% of the data for compliance with the established QC criteria based on the following categories:

- holding times,
- blanks,
- LCSs,
- surrogate recovery (organic methods),
- internal standards (primarily organic methods),
- ICP or atomic absorption QC,
- calibration,
- sample reanalysis,
- secondary dilutions, and

• laboratory case narrative.

SAIC will coordinate with the laboratories for delivery of data packages to Scotts.

Electronic deliverables must have file structure defined in this table. The deliverable file may be either an ASCII text file, a dBASE compatible file (DBF file extension), or an Excel spread sheet file (XLS file extension). All fields must be presented. Fields that are not applicable for the reported method shall be reported as blank.

Selected project data and associated QC will be evaluated based on these categories, with respect to Project DQOs and other applicable criteria, and qualified as needed. Information gathered during this validation process will be consistent with the SAIC validation forms containing documentation will be completed.

5.11.2.2 Primary Analytical Data Validation Categories

5.11.2.2.1 Holding Times

Evaluation of holding times bases the validity of results on the length of time from sample collection to sample preparation or sample analysis. Sample preservation must be accounted for in the evaluation of sample holding times. The evaluation of holding times is essential to establishing sample integrity and representativeness. Concerns regarding physical, chemical, or biochemical alteration of analyte concentrations can be eliminated or qualified through this evaluation.

5.11.2.2.2 Blanks

The assessment of blank analyses is performed to determine the existence and magnitude of contamination problems. The criteria for evaluation of blanks applies to any blank associated with the samples, including field, equipment, and method blanks. Contamination during sampling or analysis, if not discovered, may result in false-positive data.

Blanks will be evaluated against quantitation limit goals as specified in Table 5.4. Analytical method blanks should be below 2x these levels. National Functional Guidelines = 5x and 10x rule will be applied in comparing Field Samples to associated blanks.

5.11.2.2.3 Laboratory Control Samples

The LCS serves as a monitor of the overall performance of the analytical process, including sample preparation, for a given set of samples. Evaluation of the LCS provides confidence in or allows qualification of results based on a measurement of process control during each batch analysis.

5.11.2.2.4 Surrogate Recovery

System monitoring compounds are added to every sample, blank, matrix spike, MS, MSD, and standard. They are used to evaluate extraction, cleanup, and analytical efficiency by measuring recovery on a sample-specific basis. Poor system performance as indicated by low surrogate recoveries is one of the most common reasons for data qualification. Evaluation of surrogate recovery is critical to the provision of reliable sample-specific analytical results.

5.11.2.2.5 Internal Standards

Internal standards are utilized to evaluate and compensate for sample-specific influences on the analyte quantification. They are evaluated to determine if data require qualification due to excessive variation in acceptable internal standard quantitative or qualitative performance measures. For example, a decrease or increase in internal standard area counts for organics may reflect a change in sensitivity that can be attributed to the sample matrix. Because quantitative determination of analytes is based on the use of internal standards, evaluation is critical to the provision of reliable analytical results.

5.11.2.2.6 Furnace Atomic Absorption QC

Duplicate injections and furnace post-digestion spikes are evaluated to establish precision and accuracy of individual analytical determinations. Because of the nature of the furnace atomic absorption technique and because of the detailed decision tree and analysis scheme required for quantitation of the elements, evaluation of the QC is critical to ensuring reliable analytical results.

5.11.2.2.7 Calibration

The purpose of initial and continuing calibration verification analyses is to verify the linear dynamic range and stability of instrument response. Instrument response is one factor used to quantitate the analyte results. If the instrument calibration is outside acceptable limits, the data quantification is uncertain and requires appropriate qualification.

5.11.2.2.8 Sample Reanalysis

When instrument performance-monitoring standards indicate an analysis is out of control, the laboratory is required to reanalyze the sample. If the reanalysis does not solve the problem (i.e., surrogate compound recoveries are outside the limits for both analyses), the laboratory is required to submit data from both analyses. An independent review is required to determine which is the appropriate sample result.

5.11.2.2.9 Secondary Dilutions

When the concentration of any analyte in any sample exceeds the initial calibration range, the sample must be diluted and reanalyzed. The laboratory is required to report data from both analyses. When this occurs, an independent review of the data is required to determine the appropriate results to be used for that sample. An evaluation of each analyte exceeding the calibration range must be made, including a review of the dilution analysis performed. Results chosen in this situation may be a combination of both the original results (i.e., analytes within initial calibration range) and the secondary dilution results.

5.11.2.2.10 Laboratory Case Narratives

Analytical laboratory case narratives are reviewed for specific information concerning the analytical process. This information is used to direct the data validator to potential problems with the data.

5.11.3 Project Analytical Data Set

Analytical data for this project will be screened electronically and validated by qualified chemists. Flags signifying the usability of data will be noted and entered into an analytical database. Deficiencies in data deliverables will be corrected through direct communication with the field or laboratory, generating immediate response and resolution. All significant data discrepancies noted during the validation process will be documented and sent to the laboratory for clarification and correction through the NCR.

Decisions to repeat sample collection and analyses may be made by the SAIC Project Manager based on the extent of the deficiencies and their importance in the overall context of the project.

All data generated for investigations will be computerized in a format organized to facilitate data review and evaluation. The computerized data set will include data flags in accordance with the above-referenced protocols as well as additional comments of the Data Review Team. The associated data flags will include such items as: (1) estimated concentration below-required reporting limit; (2) estimated concentration due to poor calibration, internal standard, or surrogate recoveries; (3) estimated concentration due to poor spike recovery; and (4) estimated concentration of chemical that was also determined in an associated blank.

SAIC data assessment will be accomplished by the joint efforts of the data validator, the data assessor, and the Project Manager. Data assessment by data management will be based on field information that the sample was properly collected and handled according to the Field Sampling Plan and Sections 5.4 and 5.5 of this QAPP. An evaluation of data accuracy, precision, sensitivity and completeness, based on criteria in Section 5.9 of this QAPP, will be performed by a data assessor and presented to the SAIC Project Manager. This data quality assessment will indicate whether data are: (1) usable as a quantitative concentration, (2) usable with caution as an estimated concentration, or (3) unusable due to out-of-control QC results.

Project investigation data sets will be available for controlled access by the SAIC Project Manager and authorized personnel. Each data set will be incorporated into investigation reports as required.

5.11.4 Data Reporting

Laboratories will prepare and submit analytical and QC data reports to SAIC in compliance with the requirements of this QAPP, the Laboratory SOW, Laboratory SOPs and EPA Guidance, including data forms listed in Table 11.1. An electronic copy of data will be provided in an ASCII data file, CLP format, or other compatible format for entry into the SAIC data base. An acceptable configuration is presented in Table 5.11.2 with all QA/QC sample data being provided in a companion ASCII file.

The laboratory will be required to confirm sample receipt and log-in information. The laboratory will return a copy of the completed COC and confirmation of the laboratory's analytical log-in to SAIC within 24 hours of sample receipt.

The subcontract analytical laboratory will prepare and retain full analytical and QC documentation similar to that required by CLP. Such retained documentation will include all hard copies and other

storage media (e.g., magnetic tape). As needed, the subcontract analytical laboratory will make available all retained analytical data information.

5.12 PREVENTIVE MAINTENANCE PROCEDURES

5.12.1 Field Instruments And Equipment

The field equipment for this project may include temperature probes; pH meters; oxidation-reduction potential meters; conductivity meters; and dissolved oxygen levels. Specific preventative maintenance procedures to be followed for field equipment are those recommended by the manufacturers. These procedures are included in the technical procedures governing the use of these instruments.

Field instruments will be checked and/or calibrated before they are shipped or carried to the field. Each field instrument will be checked daily against a traceable standard or reference with a known value to ensure that the instrument is in proper calibration. Instruments found to be out of calibration will be recalibrated before use in the field. If the instrument cannot be calibrated, it will be returned to the supplier or manufacturer for recalibration, and a back-up instrument will be used in its place. Calibration checks and calibrations will be documented on the Field Meter/Calibration Log Sheets in the M&TE Log Book. Any maintenance conducted on field equipment must be documented in the M&TE Log Book.

Critical spare parts such as tapes, papers, pH probes, electrodes, and batteries will be kept on site to minimize down time of malfunctioning instruments. Back-up instruments and equipment will be available on site or within 1-day shipment to avoid delays in the field schedules.

5.12.2 Laboratory Instruments

As part of their QA/QC Program, a routine preventive maintenance program will be conducted by all investigation-associated laboratories to minimize the occurrence of instrument failure and other system malfunctions. All laboratory instruments will be maintained in accordance with manufacturers' specifications and the requirements of the specific method employed. This maintenance will be carried out on a regular, scheduled basis and will be documented in the laboratory instrument service log book for each instrument. Emergency repair or scheduled manufacturer's maintenance will be provided under a repair and maintenance contract with factory representatives.

5.13 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the Field Sampling Plan and QAPP. Audits of laboratory activities will include both internal and external audits.

5.13.1 Laboratory Audits

The USEPA conducts on-site audits and validates laboratories on a regular basis. These independent on-site systems audits in conjunction with performance evaluation samples (performance audits) qualify laboratories to perform environmental analysis.

These system audits include examining laboratory documentation of sample receiving, sample login, sample storage, COC procedures, sample preparation and analysis, instrument operating records, etc. Performance audits consist of sending performance evaluation samples to laboratories for on-going assessment of laboratory precision and accuracy. The analytical results of the analysis of performance evaluation samples are evaluated by USEPA to ensure that laboratories maintain an acceptable performance.

Internal performance and system audits of laboratories will be conducted by the Subcontractor Laboratory QA Officer as directed in the laboratory QA plan. These system audits will include examination of laboratory documentation of sample receiving, sample log-in, sample storage, COC procedures, sample preparation and analysis, instrument operating records, etc. Internal performance audits are also conducted on a regular basis. Single-blind performance samples are prepared and submitted along with project samples to the laboratory for analysis. The Laboratory QA Officer will evaluate the analytical results of these single-blind performance samples to ensure that the laboratory maintains acceptable performance.

External audits may be conducted in conjunction with or at the direction of the EPA Region or the State of Ohio regulatory agency.

5.14 QA REPORTS TO MANAGEMENT

5.14.1 Quality Assurance Reports

Each laboratory will provide analytical QC summary statements (case narratives) with each data package. All COC forms will be compared with samples received by the laboratory and any differences in the COC forms and the sample labels or tags are to be reported to SAIC. All deviations will be identified on the receiving report such as broken or otherwise damaged containers. This report will be forwarded to SAIC within 24 hours of sample receipt and will include the following: a signed copy of the COC form; itemized SAIC sample numbers; laboratory sample numbers; cooler temperature upon receipt; and itemization of analyses to be performed.

Summary QC statements will accompany analytical results as they are reported by the laboratory in the form of case narratives for each sample delivery group.

SAIC will maintain custody of the project evidence file and will maintain the contents of files for this project, including all relevant records, reports, logs, field logbooks, pictures, subcontractor reports, correspondence, and COC forms, until this information is transferred to the Scotts Project Manager. These files will be stored under custody of the SAIC Project Manager. Analytical laboratories will retain all original analytical raw data information (both hard copy and electronic) in a secure, limited access area and under custody of the laboratory Project Manager.
5.14.2 SAIC Quality Assurance Reports

The Project Manager may prepare summary reports of the performance of the measurement systems and the corresponding data quality. These QA Reports would address the following:

- Results of performance audits of all field sampling and laboratory analysis activities performed during the subject reporting period
- Results of system audits
- Assessment of measurement data accuracy, precision, completeness, and comparability including review of all laboratory measurement data
- Any out of control situations found during sampling activities

This activity will include assignment of flags to data, documentation of the reason(s) for the assignments, and description of any other data discrepancies. SAIC will then prepare a quality control summary report (QCSR), which will be included as an appendix or section to the final report. This report will be submitted to Scotts Project Manager as determined by the project schedule. The contents of the QCSR will include data validation discussion of all data that may have been compromised or influenced by aberrations in the sampling and analytical processes. Problems encountered, corrective actions taken, and their impact on project DQOs will be determined.

The following are examples of elements to be included in the QCSR as appropriate.

- Laboratory QC evaluation and summary of the data quality for each analytical type and matrix.
- Part of the accuracy, precision, and sensitivity summarized in the data quality assessment.
- Field QC evaluation and summary of data quality relative to data usability. Part of the accuracy, precision, and sensitivity summarized in the data quality assessment.
- Overall data assessment and usability evaluation.
- Summary of lessons learned during project implementation.

Specific elements to be evaluated within the QCSR include the following:

- sample results,
- field and laboratory blank results,
- laboratory control sample percent recovery (method dependent),
- sample matrix spike percent recovery (method dependent),
- matrix spike/matrix spike duplicate or sample duplicate RPD (method dependent),
- analytical holding times, and
- surrogate recovery, when appropriate.

5.15 REFERENCES

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- American Society of Testing and Materials (ASTM), 1996. Annual Book of ASTM Standards, Volume 04.08, Soil and Rock.
- U. S. Environmental Protection Agency (EPA), 1985. NEIC Policies and Procedures, EPA-300/9-78DDI-R, Revised June.
- EPA, 1991. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80.
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- EPA, 1994a. EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA QA/R-5, January.
- EPA, 1994b. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA-540/R-94/012, February.
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- Science Applications International Corp (SAIC) 1995. SAIC Quality Assurance Technical Procedures, Vol. 1: Data Management, Data Validation, TP-DM-300-7.

Media	Investigative Units	Analytical Parameter	Test Method	Field Samples	Field Duplicate Samples	MS/MSD Samples	Rinsate Samples	Total
Soil		SVOCs	SW-846 3540/8270	12	2	1	1	16
	Background	Metals, full suite	SW-846 3050 /6010B, 6020, and 7000 series	12	2	1	1	16
		Pesticides	SW-846 3540/8081	12	2	1	1	16
		Herbicides	SW-846 3540/8150A	12	2	1	1	16
		SVOCs	SW-846 3540/8270	4	1	0	l	6
	Field Broadcast Area 1	Metals, full suite	SW-846 3050 /6010B, 6020, and 7000 series	8	1	0	1	10
	(FBA 1)	Pesticides	SW-846 3540/8081	4	1	0	1	6
		Herbicides	SW-846 3540/8150A	4	1	0	1	6
		SVOCs	SW-846 3540/8270	3 surface 1 subsurface	1	0	1	6
	Field Braodcast Area 2	Metals, full suite	SW-846 3050 /6010B, 6020, and 7000 series	6 surface 1 subsurface	1	0	1	9
	(FBA 2)	Pesticides	SW-846 3540/8081	3 surface 1 subsurface	1	0	1	6
		Herbicides	SW-846 3540/8150A	3 surface 1 subsurface	1	0	l	6
	Pond 7 (FBA 2)	SVOCs	SW-846 3540/8270	l surface 3 subsurface	1	0	1	6

Table 5.1 Sampling and Analytical Requirements for the Scotts Facility

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Media	Investigative Units	Analytical Parameter	Test Method	Field Samples	Field Duplicate Samples	MS/MSD Samples	Rinsate Samples	Total
		Metals, full suite	SW-846 3050 /6010B, 6020, and 7000 series	l surface 3 subsurface	1	0	1	6
		Pesticides	SW-846 3540/8081	1 surface 3 subsurface	1	0	1	6
i i		Herbicides	SW-846 3540/8150A	l surface 3 subsurface	1	0	I	6
		TCLP	SW-846 1311/8270/ 6010B, 6020, and 7000 series/ 8081/ 8150A	1	0	0	0	1
Soil	Pond 7 (FBA 2)	Geotechnical	ASTM-D422/ ASTM- D2216/EPA 1110-2-1926, Appendix A/ EPA-9080A/ EPA-9060A/ ASTM-4972	2	0	0	0	2
		SVOCs	SW-846 3540/8270	1 surface 3 subsurface	1	0	1	6
		Metals, full suite	SW-846 3050 /6010B, 6020, and 7000 series	l surface 3 subsurface	1	0	1	6
		Pesticides	SW-846 3540/8081	1 surface 3 subsurface	1	0	1	6
	Pond 8	Herbicides	SW-846 3540/8150A	l surface 3 subsurface	1	0	1	6
	(FBA 2)	TCLP	SW-846 1311/8270/ 6010B, 6020, and 7000 series/8081/815 0A	l	0	0	0	1
		Geotechnical	ASTM-D422/ ASTM- D2216/EPA 1110-2-1926, Appendix A/ EPA-9080A/ EPA-9060A/ ASTM-4972	2	0	0	0	2
	Pond 2	SVOCs	SW-846 3540/8270	7 surface 13subsurface	2	1	1	22
		Metals, full suite	SW-846 3050 /6010B, 6020, and 7000 series	8 surface 13subsurface	2	1	I	23

Table 5.1 Sampling and Analytical Requirements for the Scotts Facility (Cont'd)

Media	Investigative Units	Analytical Parameter	Test Method	Field Samples	Field Duplicate Samples	MS/MSD Samples	Rinsate Samples	Total
		Pesticides	SW-846 3540/8081	7 surface 13subsurface	2	1	1	22
		Herbicides	SW-846 3540/8150A	7 surface 13subsurface	2	1	1	22
	* - -	Total Organic Carbon	SW-846 9160	2	1	1	1	5
		TCLP	SW-846 1311/8270/ 6010B, 6020, and 7000 series /8081/ 8150A	1	0	0	0	1
Soil	Pond 2	Geotechnical	ASTM-D422/ ASTM- D2216/EPA 1110-2-1926, Appendix A/ EPA-9080A/ EPA-9060A/ ASTM-4972	2	0	0	0	17
		SVOCs	SW-846 3540/8270	6 surface 6 subsurface	2	1	1	16
		Metals, full suite	SW-846 3050 /6010B, 6020, and 7000 series	6 surface 6 subsurface	2	1	1	16
		Pesticides	SW-846 3540/8081	6 surface 6 subsurface	2	1	1	16
	Pond 3	Herbicides	SW-846 3540/8150A	6 surface 6 subsurface	2	I	I	16
		TCLP ·	SW-846 1311/8270/ 6010B, 6020, and 7000 series/ 8081/ 8150A	1	0	0	0	1
		Geotechnical	ASTM-D422/ ASTM- D2216/EPA 1110-2-1926, Appendix A/ EPA-9080A/ EPA-9060A/ ASTM-4972	2	0	0	0	2
	_*	SVOCs	SW-846 3540/8270	5 surface 3 subsurface	1	0	1	10
	Pond 6	Metals, full suite	SW-846 3050 /6010B, 6020, and 7000 series	5 surface 3 subsurface	1	0	1	10

Table 5.1 Sampling and Analytical Requirements for the Scotts Facility (Cont'd)

Media	Investigative Units	Analytical Parameter	Test Method	Field Samples	Field Duplicate Samples	MS/MSD Samples	Rinsate Samples	Total
		Pesticides	SW-846 3540/8081	5 surface 3 subsurface	1	0	1	10
		Herbicides	SW-846 3540/8150A	5 surface 3 subsurface	1	0	1	10
		TCLP	SW-846 1311/8270/ 6010B, 6020, and 7000 series/ 8081/ 8150A	1	0	0	0	1
		Geotechnical	ASTM-D422/ ASTM- D2216/EPA 1110-2-1926, Appendix A/ EPA-9080A/ EPA-9060A/ ASTM-4972	2	0	0	0	2
Sediment		SVOCs	SW-846 3540/8270	21	2	1	1	25
		Metals, full suite	SW-846 3050 /6010B, 6020, and 7000 series	21	2	1	1	25
	Crosses Run	Pesticides	SW-846 3540/8081	21	2	1	1	25
		Herbicides	SW-846 3540/8150A	21	2	1	1	25
		TCLP	SW-846 1311/8270/ 6010B, 6020, and 7000 series/8081/815 0A	2	0	0	0	2
Surface Water		SVOCs .	SW-846 3510/8270	13	2	l	1	17
	Crosses Run	Metals, full suite	SW-846 3020 /6010B, 6020, and 7000 series	13	2	1	1	17
		Pesticides	SW-846 3510/8081	13	2	1	1	17
		Herbicides	SW-846 3510/8150A	13	2	1	1	17
Ground- water	Background	SVOCs	SW-846 3510/8270	3	1	0	1	5

Table 5.1 Sampling and Analytical Requirements for the Scotts Facility (Cont'd)

Media	Investigative Units	Analytical Parameter	Test Method	Field Samples	Field Duplicate Samples	MS/MSD Samples	Rinsate Samples	Total
		Metals, full suite	SW-846 3020 /6010B, 6020, and 7000 series	3	1	0	1	5
		Pesticides	SW-846 3510/8081	3	1	0	1	5
		Herbicides	SW-846 3510/8150A	3	1	0	1	5
		SVOCs	SW-846 3510/8270	1	0	0	0	1
	Landfill 1	Metals, full suite	SW-846 3020 /6010B, 6020, or 7000 series	1	0	0	0	1
		Pesticides	SW-846 3510/8081	1	0	0	0	1
		Herbicides	SW-846 3510/8150A	1	0	0	0	1
	Landfill 2	SVOCs	SW-846 3510/8270	1	0	0	0	1
Ground- water		Metals, full suite	SW-846 3020 /6010B, 6020, and 7000 series	1	0	0	0	1
		Pesticides	SW-846 3510/8081	1	0	0	0	1
		Herbicides	SW-846 3510/8150A	1	0	0	0	1
		SVOCs	SW-846 3510/8270	1	0	0	0	1
		Metals, full suite	SW-846 3020 /6010B, 6020, and 7000 series	1	0	0	0	1
•	Landfill 3	Pesticides	SW-846 3510/8081	1	0.	0	0 .	1
 		Herbicides	SW-846 3510/8150A	1	0	0	0	1
		SVOCs	SW-846 3510/8270	2	0	0	1	3
	Landfill 4	Metals, full suite	SW-846 3020 /6010B, 6020, and 7000 series	2	0	0	1	3
		Pesticides	SW-846 3510/8081	2	0	0	1	3

Table 5.1 Sampling and Analytical Requirements for the Scotts Facility (Cont'd)

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Media	Investigative Units	Analytical Parameter	Test Method	Field Samples	Field Duplicate Samples	MS/MSD Samples	Rinsate Samples	Total
		Herbicides	SW-846 3510/8150A	2	0	0	l	3
		SVOCs	SW-846 3510/8270	2	1	0	1	4
i	Landfill 5	Metals. full suite	SW-846 3020 /6010B, 6020, and 7000 series	2	1	0	1	4
		Pesticides	SW-846 3510/8081	2	1	0	1	4
		Herbicides	SW-846 3510/8150A	2	1	0	1	4
		SVOCs	SW-846 3510/8270	3	0	0	1	4
	Field Broadcast Area 1	Metals, full suite	SW-846 3020 /6010B, 6020, and 7000 series	3	0	0	1	4
	(FBA 1)	Pesticides	SW-846 3510/8081	3	0	0	1	4
		Herbicides	SW-846 3510/8150A	3	0	0	1	4
Ground- water		SVOCs	SW-846 3510/8270	2	1	0	1	4
	Field Broadcast	Metals, full suite	SW-846 3020 /6010B, 6020, and 7000 series	2	1	0	1	4
	Area 2 (FBA 2)	Pesticides	SW-846 3510/8081	2	1	0	1	4
		Herbicides	SW-846 3510/8150A	2	1	0	1	4
		SVOCs	SW-846 3510/8270	1	0	0	0	1
	Pond 7	Metals, full suite	SW-846 3020 /6010B, 6020, and 7000 series	1	0	0	0	1
	(FBA 2)	Pesticides	SW-846 3510/8081	1	0	0	0	1
		Herbicides	SW-846 3510/8150A	1	0	0	0	1
	Pond 8 (FBA 2)	SVOCs	SW-846 3510/8270	1	0	0	0	1

Table 5.1 Sampling and Analytical Requirements for the Scotts Facility (Cont'd)

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Table 5.1	Sampling and	Analytical	Requirements	for the	Scotts	Facility	(Cont'd)
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Media	Investigative Units	Analytical Parameter	Test Method	Field Samples	Field Duplicate Samples	MS/MSD Samples	Rinsate Samples	Total
		Metals, full suite	SW-846 3020 /6010B, 6020, and 7000 series	1	0	0	0	1
		Pesticides	SW-846 3510/8081	1	0	0	0	1
		Herbicides	SW-846 3510/8150A	1	0	0	0	1
		SVOCs	SW-846 3510/8270	2	1	0	1	4
	Pond 2	Metals, full suite	SW-846 3020 /6010B, 6020, and 7000 series	2	1	0	I	4
		Pesticides	SW-846 3510/8081	2	1	0	1	4
	·	Herbicides	SW-846 3510/8150A	2	1	0	1	4
		SVOCs	SW-846 3510/8270	2	0	0	1	3
	Pond 3	Metals, full suite	SW-846 3020 /6010B, 6020, and 7000 series	2	0	0	l	3
		Pesticides	SW-846 3510/8081	2	0	0	1	3
Ground- water		Herbicides	SW-846 3510/8150A	2	0	0	1	3
		SVOCs	SW-846 3510/8270	1	0	0	1	2
	Pond 6	Metals, full suite	SW-846 3020 /6010B, 6020, and 7000 series	1	0	0	1	2
	- • •	Pesticides	SW-846 3510/8081	1	0	0	1	2
		Herbicides	SW-846 3510/8150A	1	0	0	1	2

Data Use	Sample Type	Analytical Method	Precision Field Dups	(RPD ¹) Lab Dups	Accuracy Laboratory (MS)	Completeness
		Field	Methods			
Screening for sample site selection	Discrete	NA	NA	NA	NA	NA
	*****	Laborat	ory Methods	·		
Confirmation of contamination extent	Discrete or Composite	SW-8270B Semivolatile Organics	<50 RPD	<35 RPD	30-140% recovery	90%
		SW-8081A Pesticides	<50 RPD	<35 RPD	35-135% recovery	90%
		SW-8150 Herbicides	<50 RPD	<35 RPD	35-135% гесоvегу	90%
		SW-6010A/6020/ 7000 Metals	<50 RPD	<35 RPD	75-125% recovery	90%
Determination of Waste	Discrete or Composite	Waste Characteristics	NA RPD	<40	50-150% гесоvегу	90%
Characteristics		Physical Testing	NA	<40 RPD	NA	90%

Table 5.2 Soil DQO Summary

¹RPD = Relative Percent Difference, at values within five times the reporting level; comparison is acceptable if values are plus or minus three times the reporting level.

These DQOs will also apply to waste, IDW, and sediment sample media.

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Data Use	Sample Type	Analytical Method	Precision Field Dups	(RPD ¹) Lab Dups	Accuracy Laboratory (MS)	Completeness
			Field Method	s		
Determination of basic water characteristics	Discrete	EPA-120.1 Conductivity	<10 RPD	NA	+/- 10 µmhos/cm	95%
		EPA-150.1 pH	<10 RPD	NA	+/- 0.1 s.u.	95%
		EPA-170.1 Temperature	<10 RPD	NA	NA	95%
		L	aboratory Met	nods		
Confirmation of contamination extent	Discrete or Composite	SW-8270B Semivolatile Organics	<30 RPD	<20 RPD	30-140% гесоvегу	90%
		SW-8081A Pesticides	<30 RPD	<20 RPD	35-135% recovery	90%
		SW-6010A/ 6020/7000 Metals	<30 RPD	<20 RPD	75-125% recovery	90%
		SW-8150 Herbicides	<30 RPD	<20 RPD	35-135% recovery	90%

Table 5.3 Groundwater, Surface Water, and Field QC Investigative DQO Summaryfor Scotts Investigations

 1 RPD = Relative Percent Difference, at values within five times the reporting level; comparison is acceptable if values are plus or minus two times the reporting level.

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	Analytical Methods		Project Q	uantitation Levels*
Parameters	Water	Soil/Sediment	Water	Soil/Sediment
Semivolatile Organic Compounds (SVOCs):	SW 846- 3520/8270B ^b	SW 846-3550/8270B ^b	(ug/L)	(ug/kg)
Phenol			10	330
bis(2-Chloroethyl) ether			10	330
2-Chiorophenol			10	330
1,3-Dichlorobenzene			10	330
1,4-Dichlorobenzene			10	330
1,2-Dichlorobenzene			10	330
2-Methylphenol			10	330
2,2'- oxybis(1-Chloropropane)			10	330
4-Methylphenol			10	330
N-nitroso-di-n-dipropylamine			10	330
Hexachloroethane			10	330
Nitrobenzene	•		10	330
Isophorone			10	330
2-Nitrophenol			10	330
2,4-Dimethylphenol			10	330
bis(2-chloroethoxy) methane			10	330
2,4-Dichlorophenol			10	330
1,2,4-Trichlorobenzene			10	330
Naphthalene	· · · · · · · · · · · · · · · · · · ·		10	330
4-Chloroaniline			10	330
Hexachlorobutadiene			10	330
4-chloro-3-methylphenol			10	330
2-Methylnaphthalene			10	330
Hexachlorocyclopentadiene			10	330
2,4,6-Trichlorophenol			10	330
2.4,5-Trichlorophenol			25	800
2-Chloronaphthalene			10	330
2-Nitroaniline			25	800
Dimethylphthalate			10	330
Acenaphthylene			10	330
2,6-Dinitrotoluene			10	330
3-Nitroaniline			25	800
Acenaphthene			10	330
2,4-Dinitrophenol			25	800
4-Nitrophenol			25	800

Table 5.4 Analytical/Methods, Parameters, and Project Quantitation Limits for the Scotts Site Investigations

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Table 5.4 (continued)

	Analy	tical Methods	Project Q	uantitation Levels [*]
Parameters	Water	Soil/Sediment	Water	Soil/Sediment
Dibenzofuran			10	330
2,4-Dinitrotoluene			10	330
Diethylphthalate			10	330
4-Chlorophenyl-phenyl ether			10	330
Fluorene			10	330
4-Nitroaniline			25	800
4,6-Dinitro-2-methylphenol			25	800
N-nitrosodiphenylamine			10	330
4-bromophenyl-phenylether			10	330
Hexachlorobenzene			10	330
Pentachiorophenol (COPC)			25	800
Phenanthrene			10	330
Anthracene			10	330
Carbazole			10	330
Di-n-butylphthalate			10	330
Fluoranthene			10	330
Pyrene			10	330
Butylbenzylphthalate			10	330
3,3'-Dichlorobenzidine	1		10	330
Benzo(a)anthracene			10	330
Chrysene			10	330
bis(2-Ethylhexyl)phthalate			10	330
Di-n-octylphthalate			10	330
Benzo(b)fluoranthene			10	330
Benzo(k)fluoranthene			10	330
Benzo(a)pyrene	-		10	330
Indeno(1,2,3-cd)pyrene			10	330
Dibenzo(a,h)anthracene			10	330
Benzo(g,h,i)perylene			10	330
Pesticides:	SW 846- 3510/8081 ^b	SW 846- 3540/8081 ^b	(ug/L)	(ug/kg)
alpha-BHC			0.05	1.7
beta-BHC			0.05	1.7
Gamma-BHC (Lindane)			0.05	1.7
Heptachlor			0.05	1.7
Aldrin			0.05	1.7
Heptachlor epoxide			0.05	1.7
Endosulfan I			0.05	1.7

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Table 5.4 (continued)

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	Analy	tical Methods	Project Quantitation Levels*	
Parameters Dieldrin	Water	Soil/Sediment	Water 0.1	Soil/Sediment 3.3
Endrin			0.1	3.3
Endosulfan II			0.1	3.3
4,4'-DDD	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		0.1	3.3
Endosulfan sulfate			0.1	3.3
4,4'-DDT			0.1	3.3
Methoxychlor			0.5	17.0
Endrin ketone			0.1	3.3
Endrin ketone			0.1	3.3
Endrin aldehyde			0.1	3.3
Alpha-chlordane			0.05	1.7
Gamma-chlordane			0.05	1.7
Toxaphene			5	170
Herbicides:	SW 846- 3510/8150A ^b	SW 846- 3540/8150A ^b	(ug/L)	(ug/kg)
2,4-D		· · · · · · · · · · · · · · · · · · ·	1.2	
2,4-DB		<u> </u>	0.91	
2,4,5 - T			0.2	
2,4,5-TP (Silvex)			0.17	· · · · · ·
Dalapon			5.8	
Dicamba			0.27	
Dichloroprop			0.65	
Dinoseb			0.07	
МСРА			249	
МСРР			192	
Metals(Target Analyte List):	SW 846- 3010A/6010B, 6020, or 7000 series ^b	SW 846-3050A/6010B, 6020, or 7000 series ^b	(ug/L)	(mg/kg)°
Aluminum			50	5
Antimony			. 5	0.5
Arsenic			5	0.5
Barium			5	0.5
Beryllium			1	0.1
Cadmium			1	0.1
Calcium			50	5
Chromium			5	0.5
Cobalt			5	0.5
Copper	_		5	0.5
Iron		1 1	10	1.0
Lead			3	0.3

Table	5.4	(contination)	ued)
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	Analy	tical Methods	Project Quantitation Levels*	
Parameters	Water	Soil/Sediment	Water	Soil/Sediment
Magnesium			50	5
Manganese			5	0.5
Mercury (CVAA)	SW 846-7470	SW 846-7471	0.2	0.1
Nickel	SW 846- 3010A/6010B, 6020, or 7000 series ^b	SW 846-3010A/6010B, 6020, or 7000 series ^b	10	1.0
Potassium			50	5
Selenium			5	0.5
Silver			5	0.5
Sodium			50	5
Thallium			2	0.2
Vanadium			10	0.2
Zinc			5	0.5

^aThese are expected quantitation limits based on reagent grade water or a purified solid matrix. Actual quantitation limits may be higher depending upon the nature of the sample matrix. The limit reported on final laboratory reports will take into account the actual sample volume or weight, percent solids (where applicable), and the dilution factor, if any. The quantitation limits for additional analytes to this list may vary, depending upon the results of laboratory studies. All solids will be reported on a dry weight basis, with the associated sample percent moisture reported separately.

^bTest Methods for Evaluating Solid Waste, U.S. EPA, SW-846 Third Edition.

'Estimated detection limits for metals in soil are based on a 2-gram sample diluted to 200 mL.

^dMethods for Chemical Analysis of Water and Wastes, U.S. EPA-600/4-79-020.

Table 5.5	Analytical/Methods, Parameters, and Project Quantitation Limits
	for Scotts Site Investigations Waste Characteristics

Parameters	Analytical Methods	Project Quantitation Levels*
SVOCs (TCLP Analyte List)	SW 846-1311 (extraction) SW 846-8270B ^b	Leachate(µg/L) ^c
1,4-Dichlorobenzene'		75
2-Methylphenol (o-cresol)		2000
3-Methylphenol (m-cresol)		2000
4-Methylphenol (p-cresol)		2000
Hexachloroethane		30
Nitrobenzene		20
Hexachlorobutadiene		50d
2,4,6-Trichlorophenol		20
2,4,5-Trichlorophenol		4000
2,4-Dinitrotoluene		13d
Hexachlorobenzene		13d
Pentachlorophenol		1000
Pyridine		500d
Pesticides (TCLP Analyte List)	SW 846-1311 (extraction) SW 846-8081A ^b	Leachate(µg/L)
Gamma-BHC (Lindane)		4.0
Heptachlor		0.08
Heptachlor epoxide		0.08
Endrin		0.2
Methoxychlor		100
Chlordane (total)		0.3
Toxaphene		5.0
Herbicide Compounds (TCLP - Analyte List)	SW 846-1311 (extraction) SW 846-8150 ^b	Leachate(µg/L)
2,4-D		100
2,4,5-TP (silvex)		10
Metals (TCLP Analyte List)	SW 846-1311 (extraction) 6010B, 6020, or 7000 series ^b	Leachate(µg/L)
Arsenic		50
Barium .		100
Beryllium		50
Cadmium		10
Chromium		50
Copper		50

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Parameters	Analytical Methods	Project Quantitation Levels
Lead		30
Mercury (CVAA)	SW 846-7470b	20
Selenium	SW 846-1311 (extraction) 6010B, 6020, or 7000 series ^b	10
Silver		50
Zinc		50
Waste Characteristics		
Ph	SW 846-9045b	NA
Corrosivity (to steel)	SW 846-1110 ^b	corrosion rate
Paint Filter Liquid Test(free liquids)	SW 846-9095b	0.1%
Cyanide Reactivity	SW 846-Chapter 7 ^b	2.5 mg/kg
Sulfide Reactivity	SW 846-Chapter 7 ^b	5.0 mg/kg
Ignitablity	SW 846-Chapter 7b	NA
Total Petroleum Hydrocarbons (TPH)	SW 846-9073b	10 mg/kg
Total Organic Halides (TOX)	SW 846-9020b	5 mg/Kg

^aThese are expected quantitation limits based on reagent grade water or a purified solid matrix. Actual quantitation limits may be higher depending upon the nature of the sample matrix. The limit reported on final laboratory reports will take into account the actual sample volume or weight, percent solids (where applicable), and the dilution factor, if any. The quantitation limits for additional analytes to this list may vary, depending upon the results of laboratory studies. ^bTest Methods for Evaluating Solid Waste, U.S. EPA, SW-846 Third Edition.

Quantitation goals are set at 0.01X the regulatory action level.

^dQuantitation goals are set at 0.1X the regulatory action level.

e Methods of Soil Analysis, No.9, Part 2, 2nd edition, 1982: 5-2.4.4 = x-ray fluoresence spectrometry; 26-4.3.4 = sulfuric

acid distillation followed by titration. ¹American Society for Testing and Materials, ASTM Standards, Vol. 04.08, Soil and Rock, 1996 and Vol. 11.04, Water and

Environmental Technology, 1993.

	Soil %			
	Recovery		Water % Recovery	
MS/MSD Compounds	Control Limits	Soil RPD Limit	Control Limits	Water RPD Limit
		Pesticides		
Aldrin	32-123	42	34-132	43
Dieldrin	32-145	43	31-134	38
Endrin	32-137	45	42-139	45
Heptachlor	24-168	73	35-130	31
Lindane (gamma-BHC)	28-125	51	46-127	50
4,4'-DDT	10-151	50	23-134	50
	·····	SVOC	L	
Phenol	26-90	35	12-110	42
2-Chlorophenol	25-102	50	27-123	40
1,4-Dichlorobenzene	28-104	27	36-97	28
n-Nitroso-di-n-Propylamine	41-126	38	41-116	38
1,2,4-Tricholorobenzene	38-107	23	39-98	28
4-Chloro-3-methylphenol	26-103	33	23-97	42
Acenapthene	31-137	19	46-118	31
4-Nitrophenol	11-114	50	(10-80)	50
2,4-Dinitrotoluene	28-89	47	24-96	38
Pentachlorophenol	17-109	47	9-103	50
Pyrene	35-142	36	26-127	31
Herbicides				
Dicamba	10-151	50	23-134	50
2,4-D	10-151	50	23-134	50
		Inorganic		
Metals	75-125	35	75-125	20

Table 5.6 MS/MSD Acceptance Criteria

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Table 5.7 Surrogates Criteria

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Surrogates	Soil % Recovery	Water % Recovery
	SVOC	
2-Fluorophenol	30-115	43-116
Phenol-d5	24-113	10-94
Nitrobenzene-d5	23-120	35-114
2-Fluorobiphenyl	25-121	21-100
2,4,6-Tribromophenol	25-121	10-123
Terphenyl-d14	19-122	33-141
	Pesticides	
ТМХ	60-150	60-150
DCBP	60-150	60-150
	Herbicides	
DCAA	60-150	70-130

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Analyte Group	Container	Minimum Sample Size	Preservative	Holding Time
Semivolatile Organic Compounds	1 - 8 oz glass jar with Teflon-lined cap	90 g	Cool, 4°C	14 d (extraction)40 d (analysis)
Pesticides	use same container as SVOCs	90 g	Cool, 4°C	14 d (extraction)40 d (analysis)
Metals	1 - 4 oz wide mouth plastic or glass jar	20 g	Cool, 4°C	180 d,Hg at 28 d
Herbicides	1 - 8 oz glass jar with Teflon7-lined cap	90 g	Cool, 4°C	14 d (extraction)40 d (analysis)
Waste Characteristics	1 - 16 oz wide mouth glass jar with Teflon7-lined cap	1000 g	Cool, 4°C	general 14 d

Table 5.8 Container Requirements for Soil Samples for Scotts Investigations

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Analyte Group	Container	Minimum Sample Size	Preservative	Holding Time
Semivolatile Organic Compounds	2 - 1L amber glass bottle with Teflon7-lined lid ¹	1000 mL	Cool, 4°C	7 d (extraction)40 d (analysis)
Pesticides	2 - 1L amber glass bottle with Teflon7-lined lid ¹	1000 mL	Cool, 4°C	7 d (extraction)40 d (analysis)
Metals	l - L polybottle	500 mL, metals200 mL, Hg	HNO ₃ to pH <2Cool, 4°C	180 d, metals28 d, Hg
Herbicides	2 - 1L amber glass bottle with Teflon7-lined lid ¹	1000 mL	Cool, 4°C	7 d (extraction)40 d (analysis)

Table 5.9 Container Requirements for Water Samples for Scotts Investigations

¹ One investigative water sample in twenty will require an additional volume for the laboratory to perform appropriate laboratory QC analysis. (i.e., MS/MSD).

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Instrument	Uses	Detection limits	Calibration	Comments
PH meters	Field screening of waters	N/A	2 point with standards at pH 7.0 and 4.0 or pH 7.0 and 10.0 daily	Accuracy is to 0.5 pH units
Temperature (in-line)	Determining water temperature	N/A	To manufacturer instructions	
Conductivity meter	Determining conductivity of water	N/A	1 point in KCL solution	Calculations and acceptance criteria must be available in the field
Membrane electrode meter	Determining dissolved oxygen levels	N/A	l point using calculated value for water at ATP at least once every 3 hours	Accuracy is \Box 0.01 ppm
Eh (oxidation/reduction) Probe	Field screening	N/A	Traceable Eh standard	

Table 5.10 Field Instrument Uses, Detection Limits, and Calibration

N/A = not applicable

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Method Requirements	Deliverables
 Requirements for all methods: Holding time information and methods requested Discussion of laboratory analysis, including any laboratory problems 	Signed chain-of-custody forms Case narratives
Organics: GC/MS analysis - Sample results, including TICs - Surrogate recoveries - Matrix spike/spike duplicate data - Method blank data - GC/MS tune - GC/MS initial calibration data - GC/MS continuing calibration data - GC/MS internal standard area data	CLP Form 1 or equivalent CLP Form 2 or equivalent CLP Form 3 or equivalent CLP Form 4 or equivalent CLP Form 5 or equivalent CLP Form 6 or equivalent CLP Form 7 or equivalent CLP Form 8 or equivalent
Organics: GC analysis - Sample results - Surrogate recoveries - Matrix spike/spike duplicate data - Initial calibration data - If calibration factors are used - Calibration curve if used - Continuing calibration data - Positive identification (second column confirmation)	CLP Form 1 or equivalent CLP Form 2 or equivalent CLP Form 3 or equivalent CLP Form 4 or equivalent CLP Form 6 or equivalent A form listing each analyte, the concentration of each standard, the relative calibration factor, the mean calibration factor, and %RSD Calibration curve and correlation coefficient CLP Form 9 or equivalent CLP Form 10 or equivalent
Metals - Sample results - Initial and continuing calibration - Method blank - ICP interference check sample - Spike sample recovery - Postdigestion spike sample recovery for ICP metals - Postdigestion spike for GFAA - Duplicates - LCS - Standard additions (when implemented) - Holding times - Run log	CLP Form 1 or equivalent CLP Form 2 or equivalent, dates of analyses and calibration curve, and the correlation coefficient factor CLP Form 3 or equivalent and dates of analyses CLP Form 4 or equivalent and dates of analyses CLP Form 5A or equivalent CLP Form 5B or equivalent CLP Form 5B or equivalent CLP Form 6 or equivalent CLP Form 7 or equivalent that includes acceptable range or window CLP Form 8 or equivalent CLP Form 13 or equivalent CLP Form 14 or equivalent

Table 5.11 Summary of Analytical Hard-copy Data Deliverables

CLP	=	contract laboratory program
GC	÷	gas chromatography
GFAA	=	graphite furnace atomic absorption
ICP	=	inductively coupled plasma
LCS	=	laboratory control sample
MS	=	mass spectrometry
RPD	=	relative percent difference
RSD	=	relative standard deviation

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TIC = tentatively identified compound

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Table 5.12	Standard	Electronic Data
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Column Position	Length	Field Description		
Header Record				
1-20	20	SAIC Project Number		
21-28	8	Data Submission Date (MM/DD/YY)		
29-33	6	Number of Records (Rows) in the file including header and terminating		
		records		
34-74	40	Submitting Laboratory Name		
	Detail Record			
1-20	20	SAIC Sample Identification Number		
21-28	8	Date of Sample Collection (MM/DD/YY)		
29-33	5	Time of Sample Collection (HH:MM military format)		
34-48	15	Laboratory Analytical Batch/Sample Delivery Group (SDG) Number		
49-56	8	Sample Matrix		
57-76	20	Laboratory Sample Identification Number		
77-84	8	Sample Extraction/Preparation Date (MM/DD/YY)		
85-92	8	Sample Analysis Date (MM/DD/YY)		
93-97	5	Sample Analysis Time (HH:MM military format)		
98-100	3	Analysis/Result Type - This field is used to designate the type of analysis performed. Valid values are as follows: REG = Regular Sample Analysis DUP = Laboratory Duplicate Analysis DIL = Secondary Dilution Analysis REn = Re- analysis where An@ is a sequential number		
101-112	12	Chemical Abstract Services (CAS) Number		
113-142	30	Analysis Name		
143-157	15	Analysis Method (Method numbers shall be the EPA, SW-846, NIOSH, etc. method number)		
158-167	10	Result (Report detection limit if not detected)		
168-172	5	Result Qualifier (U, J, etc.)		
173-180	8	Unit of measure		
181-190	10	Instrument Detection Limit		
191-195	5	Percent Solids (Report A0@ for water matrices)		
196-200	5	Sample Weight/Volume		
201-202	2	Sample Weight/Volume Units		
203-207	5	Dilution		
Termination Record				
1-3	3	\$\$\$		

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HEALTH AND SAFETY PLAN

SECTION 6

RCRA FACILITY INVESTIGATION WORK PLAN

FOR

THE SCOTTS COMPANY 14111 Scottslawn Road Marysville, Ohio 43041

June 11, 1999

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Rich Shank SAIC Program Mar	Phone: 614-791-3370	Date
Rich Carter SAIC Project Mana	Phone: 614-791-3343 ger	Date
Steve Davis SAIC Health and Sa	Phone: 423-481-4755 afety Manager	Date

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6.0 HEALTH AND SAFETY PLAN

6.1 GENERAL INFORMATION

6.1.1 Introduction

Science Applications International Corporation (SAIC) formal policy, stated in the Environmental Compliance Health and Safety (ECHS) Program Manual, is to take every reasonable precaution to protect the Health and Safety of employees, the public, and the environment. To this end, this Health and Safety Plan (HSP) sets forth the basic procedures required to protect SAIC personnel involved in field activities during the Site Investigation (SI) at The Scotts Company, Marysville, Ohio.

This plan has been prepared in accordance with the SAIC ECHS Program Manual and the requirements of Occupational Safety and Health Administration (OSHA) 29 CFR 1910.120 and 29 CFR 1926.25. It contains information about the site, potential contaminants, and hazards that may be encountered, and hazards inherent to routine site characterization procedures. This HSP describes:

- general descriptions of the site and work tasks;
- primary and contingency personal protection;
- monitoring equipment and action levels;
- personnel and equipment decontamination; and
- emergency contacts.

This HSP is designed to accommodate all anticipated contingencies and should not need revision. If unexpected conditions are encountered, this HSP will be modified to address such conditions to ensure the health and safety of all SAIC personnel, subcontractors, and other persons conducting field activities. This modification will be documented on a Field Change Order (FCO) approved by the SAIC Health and Safety Manager.

6.2 SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION

6.2.1 Site Description

The Scotts Company is located in Marysville, OH. The plant area is used for the production of lawn care chemicals. Currently the area around the Scotts company facility where the SI work will be conducted is predominantly grassland. This area may have been used or is adjacent to areas used for waste disposal according to available information.

6.2.2 Contaminants

Table 6.1 presents contaminants found in sampling soil, groundwater, and waste in the vicinity of the SI work area. Ammonia vapors may be present in the work area coming from the adjacent retention pond.

Pesticides	
Heptachior epoxide	
Endrin	
Endosultan II	
Aldrin	
Heptachlor	
Chlordane	
4,4U-DDE	
4,4U-DDD	
4.4U-DDT	
Herbicides	
2,4-D	
Dicamba	
Silvex	
2,4,5-T	
VOCs	
2-Butanone	
<u>SVOCs</u>	
Benzo (a) pyrene	
Benzo (b) fluoranthene	
Indeno (1,2,3-cd) pyrene	
Dibenzo (a,h) anthracene	
Chrysene	
Benzo (k) fluoranthene	
Benzo (a) anthracene	
Phenanthrene	
Pyrene	
Acenaphthene	
Anthracene	
Benzo (ghi) perylene	
Fluoranthene	
Naphthalene	

Table 6.1. Parameters of Concern

6.3 STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

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This section presents the lines of authority, responsibilities, and communication procedures concerning site safety and health and emergency response. It includes key Science Applications International Corporation (SAIC) and subcontractor personnel. Table 6.2 identifies the individuals who will fill key roles.

Position	Name	Phone
SAIC Program Manager	Rich Shank	614-793-7600
SAIC Health and Safety Manager	Steve Davis CIH, CSP	423-481-4755
SAIC Project Manager	Rich Carter	614-793-7600
Drilling Subcontractor Field Manager	TBD	
SAIC Operations Manager	Brad Richardson	614-793-7600
SAIC Site Health and Safety Officer	Martha Clough	937-431-2249

Table 6.2. Staff Organization

6.3.1 SAIC Program Manager

The Program Manager is responsible for ensuring conformance with SAIC Corporate, SAIC Engineering and Environmental Compliance Group (EECG) and Scotts policies and procedures. Specific responsibilities of the Program Manager include:

- coordinating with Scotts Company personnel;
- ensuring that project managers satisfy SAIC and Scotts health and safety requirements;
- ensuring that project staff implement the Health and Safety Plan (HSP);
- ensuring that projects have the necessary resources to operate safely; and
- ensuring that project personnel have the appropriate regard for safe job performance.

6.3.2 SAIC Health and Safety Manager

The SAIC Health and Safety Manager manages the EECG health and safety program. This includes establishing health and safety policies and procedures, supporting project and office activities, and verifying of safe work practices and conditions. The SAIC Health and Safety Manager is certified in the comprehensive practice of industrial hygiene by the American Board of Industrial Hygiene, is certified as a safety professional by the Board of Certified Safety Professionals, and has more than ten years of hazardous waste experience. The specific responsibilities of the Health and Safety Manager include:

- coordinating with Scotts health and safety personnel;
- reviewing and approving HSPs;
- approving downgrades in personal protective equipment (PPE) or protective procedures; and
- interfacing with project personnel through routine communications and audits of selected projects.

6.3.3 SAIC Project Manager

The Project Manager is responsible for overall project execution. The responsibilities of the Project Manager include:

- coordinating with Scotts personnel, including reporting accidents and incidents to the Environmental Coordinator immediately and submitting written reports within 2 working days;
- ensuring implementation of the HSP;
- maintaining auditable project documentation of all required records;
- ensuring that a qualified SHSO is designated; and
- maintaining a current copy of the HSP.

6.3.4 SAIC Field Operations Manager

The Field Operations Manager will oversee the field activities associated with the project and will be responsible for site accessibility, safety, and quality assurance. He/she is responsible for enforcing the field requirements of this HSP. He/she is responsible (jointly with the SHSO) to ensure that the project is conducted safely. Specific responsibilities of the Field Operations Manager are listed below:

- enforcing compliance with the HSP;
- coordinating on-site operations, including subcontractor activities;
- ensuring that subcontractors follow the requirements of this HSP;
- coordinating and controlling any emergency response actions;
- ensuring that at least two persons currently certified in first aid/CPR are on site during site operations; and
- maintaining current copies of the HSP and the SAIC EC&HS Manual on site.

6.3.5 Site Health and Safety Officer

The SHSO is responsible for making health and safety decisions, for specific health and safety activities, and for verifying the effectiveness of the health and safety program. The SHSO's qualifications include, at a minimum, experience with similar projects, knowledge of and understanding of the HSP, and the ability to use the required monitoring equipment. The SHSO has primary responsibility for the following:

• implementing and verifying compliance with this HSP and reporting to the Field Operations Manager, Project Manager, and Health and Safety Manager any deviations from anticipated conditions;

- conducting daily safety inspections;
- documenting deficiencies identified in the daily inspections and responsible parties, procedures, and timetables for correction;
- stopping work or upgrading protective measures (including protective clothing) if uncontrolled health and safety hazards are encountered. Indications of uncontrolled health and safety hazards include monitoring instrument readings in excess of the established action limits, encountering liquids other than water, soil staining suggestive of unexpectedly high concentrations of nonvolatile contaminants, etc. The SHSO must also authorize resumption of work following correction of the adverse condition(s);
- ensuring that site personnel have access to this plan and are aware of its provisions;
- conducting a site-specific pre-entry health and safety briefing covering potential hazards, safe work practices, and emergency procedures;
- maintaining on-site auditable documentation of
 - Material Safety Data Sheets (MSDSs) for applicable materials utilized at the site,
 - Inventory of hazardous chemicals
 - training for site workers and visitors,
 - calibration/maintenance of field instruments such as photoionization detectors (PID), combustible gas indicators, etc.,
 - environmental and personal exposure monitoring results,
 - notification of accidents/incidents,
 - reports of any overexposure or excessive levels,
 - notification of employees of exposure data, and
 - medical surveillance;
- confirming that all on-site personnel have received the training listed in the Training Requirements section (Section 4) of this HSP;
- issuing respirators, as necessary, and ensuring that all respirator users have received medical clearance within the last year, have been properly trained, and have been successfully fitted for respiratory protection;
- verifying that the HSP's emergency points of contact is correct;
- ensuring that all monitoring equipment is operating according to the manufacturer's specifications and performing field checks of instrument calibration;
- ensuring monitoring for potential on-site exposures is conducted in accordance with this HSP;
- updating the HSP (field changes) to ensure that it adequately identifies all tasks and significant hazards at the site and notifying project personnel and the SAIC Health and Safety Manager of changes;

- investigating accidents and near accidents and reporting (in concert with Field Operations Manager) same to Project Manager and Health and Safety Manager;
- conducting daily "tailgate" safety briefings; and
- controlling visitor access to the exclusion zone.

6.3.6 Drilling Subcontractor Field Manager

The Field Manager will oversee the field activities of his/her employees. He/she is responsible for enforcing the field requirements of this HSP. Specific responsibilities are listed below:

- ensuring that his/her personnel on site follow the requirements of the HSP and any other applicable health and safety requirements [Occupational Safety and Health Administration (OSHA), equipment-specific controls, state requirements];
- verifying that this HSP adequately addresses the hazards and controls of the subcontracted work, and supplementing the information in the HSP if necessary;
- ensuring the safe operation of any subcontractor equipment;
- coordinating on-site operations of his/her personnel; and
- maintaining any required documentation (drill rig manual) specific to his/her operations.

6.4 HAZARD ASSESSMENT

The purpose of the hazard assessment is to identify and assess potential hazards that may be encountered by personnel and to prescribe required controls. Table 6.3 is a checklist of common hazards that may be absent or present during project activities. Specific site tasks include direct push drilling technology (DPT), monitoring well installation, sampling with hand augers, groundwater sampling, surface water/sediment sampling, and equipment decontamination.

Yes	No	Hazard	Task
	X	Confined Space Entry	None
	X	Excavation	None
X		Heavy Equipment ¹	Drill Rig
X		Fire	Drilling, DPT
X		Electrical Shock	Drilling, DPT (underground utilities)
X		Exposure to Chemicals	All
X		Temperature Extremes	All
X		Biological Hazards	All
	X	Radiation or Radioactive	None
		Contamination	
X		Noise	Drilling, DPT

Table 6.3Hazards Inventory

¹The DPT is not considered heavy equipment.
6.4.1 Task-Specific Hazard Analysis

In general, given these tasks the potential for unacceptable exposure to site contaminants appears to be low. Physical hazards are also minimal with the exception of work around the moving parts of drill rigs. Temperature stress may become a concern depending on the season and weather. It is the responsibility of the Field Operations Manager and the SHSO to verify that planned hazard controls are sufficient, and if not, to take appropriate steps to assure safety.

Table 6.4 presents task-specific hazards, task-specific hazard analyses, relevant hazard controls, and required monitoring, if appropriate, for all of the planned site tasks.

6.4.2 Potential Exposures

Information on the significant suspected contaminants and chemical tools that will be used for the project is contained in Table 6.5. If additional contaminants or chemical tools that pose new or significantly greater hazards are identified prior to, or during, site activities, they will be provided as an addendum to this document.

6.5 HAZARD COMMUNICATION, TRAINING, AND MEDICAL SURVEILLANCE REQUIREMENTS

6.5.1 Hazard Communication

SAIC EC&HS Procedure 8, Hazard Communication, and 29 CFR 1910.1200 will govern hazard communication. As a minimum, the following steps will be taken.

- All hazardous materials on site will be labeled to comply with the hazard communication standard.
 - clear labeling as to the contents,
 - the appropriate hazard warning, and
 - the name and address of the manufacturer.
- MSDSs will be available on site for all hazardous materials that are present.
- Site-specific training will include the hazards posed by site chemicals, protective measures, and emergency procedures.
- Copies of MSDSs for all hazardous chemicals (chemicals brought on site) will be maintained in the work area. MSDSs will be available to all employees for review during each work shift.

Safety and Health Hazards	Controls	Monitoring	Probability			
	DPT, Monitoring well installation and associated subsurface soil sampling (drilling, lifting augers and well parts, sample processing)					
General safety hazards (rotating machinery, suspended loads, moving equipment, slips, falls)	Level D+ PPE (see PPE section) plus: Hard hat required on drill rig Workers must be a safe distance from under suspended loads	Safety inspections				
Noise	Hearing protection within 25 ft of rig	Safety inspections	High for drill rig operations			
Fire/explosion	Control of ignition sources Control of flammable material (quantities limited to single day use, proper storage) Fire extinguisher (see SOP section)	Combustible Gas Indicator as indicated by PID measurements	Very low			
Exposure to chemicals (see Table 4.3)	PPE (level D) plus nitrile or similar gloves for contact with contaminated materials Minimize contact	PID or equivalent and other sampling as appropriate	Low for all tasks			
Temperature extremes	Admin. controls (see Heat/Cold Stress)	Temperature measurements	Varies by season			
Animal hazards (bees, ticks, wasps, snakes)	PPE (boots, work clothes) Insect repellent	Visual survey	Very low			
Electric shock	Identification and clearance of overhead and underground utilities Ground fault circuit interrupters (GFCI) for hand tools	Visual of all work areas	Low			

Safety and Health Hazards	Controls	Monitoring	Probability		
Surface soil sampling and hand auger sampling					
General safety hazards (moving equipment, slips, falls)	Level D PPE (see PPE section)	Safety inspections			
Exposure to chemicals (see Table4.3)	PPE (Level D) plus nitrile or similar gloves for contact with contaminated materials Minimize contact	Safety inspections	low for all tasks		
Temperature extremes	Administrative Controls (see Heat/Cold Stress)	Temperature measurements	Varies by season		
Animal hazards (bees, ticks, wasps, snakes)	PPE (boots, work clothes) Insect repellent	Visual survey	Very low		
Electric shock	Ground fault circuit interrupters (GFCI) for hand tools	Visual of all work areas	Low		
Monitoring well development and sampling; surface water and sediment sampling					
General safety hazards (splashes, slips, falls, equipment handling)	Level D PPE (see PPE section)	Safety inspections			
Noise	Hearing protection within 25 ft for generator use	Safety inspections	Low		
Exposure to chemicals Including Nitric and Hydrochloric Acids for preservation of samples (see Table 4.3)	PPE (Level D) plus nitrile or similar gloves for contact with contaminated materials Safety glasses and nitrile gloves will be required when preserving samples with acids 15 minute eyewash required when pouring acids Minimize contact	Safety inspections	Low		
Temperature extremes	Administrative Controls (see Heat/Cold Stress)	Temperature measurements	Varies by Season		

Safety and Health Hazards	Controls	Monitoring	Probability
Animal hazards (bees, ticks, wasps, snakes)	PPE (boots, work clothes) Insect repellent	Visual survey	Very Low
Drowning (surface water/sediment sampling)	Personal Flotation Devices required when working around >3 feet of water	Safety inspections	Very Low
Electric shock	Ground fault circuit interrupters (GFCI) for hand tools, pumps as appropriate	Visual of all work areas	Low
Equip	ment decontamination (hot water washing, soap and wate	r washing, isopropanol washi	ng)
General equipment decontamination hazards (hot water, slips, falls, equipment handling)	Level D PPE (see PPE section) plus: Nitrile or polyvinyl chloride (PVC) gloves Face shield and Saranax or equivalent suit (when operating spray washer)	Safety inspections	Low
Noise (spray washer)	Hearing protection when washer is operating	Safety inspections	Low to moderate
Release of contaminants to the environment	Containment system	Observation of potential for emission	Low
Fire/explosion	Control of ignition sources Control of flammable materials (quantities limited to single day use, proper storage) Fire extinguisher (see SOP section)	Safety inspections	Low
Exposure to chemicals (see Table4.3)	Level D PPE plus nitrile or similar gloves for contact with contaminated materials Admin. controls	None	Very low

.

Table 6.4 (continued)

Safety and Health Hazards	Controls	Monitoring	Probability
Animal hazards (bees, ticks, wasps, snakes)	PPE (boots, work clothes) Insect repellent	Visual survey	Very low
Temperature extremes	Admin. controls (see Heat/Cold Stress)	Temperature measurements	Varies by season

Chemical ^a	TLV/PEL/REL/ STEL/IDLH [*]	Health effects/ potential hazard ^c	Chemical and physical properties ^c	Exposure route(s) ^c
*Gasoline (used for fuel)	TLV/TWA: 300 ppm PEL/TWA: 300 ppm IDLH: Ca	Dizziness, eye irritation, dermatitis, listed as a carcinogen by NIOSH	Liquid with aromatic odor, FP: -45EF	Absorption Inhalation Ingestion Contact
*Hydrochloric Acid (used in the preservation of samples)	Ceiling: 5 ppm TLV IDLH: 50 ppm	Inflammation of nose and throat, burns throat, eyes and skin, dermatitis, coughing, choking	Colorless gas in aqueous solution, nonflammable, IP 12.74 eV	Inhalation Ingestion Contact
*Methanol (used for equipment decontamination)	TLV/TWA: 200 ppm [skin] IDLH: 6000 ppm	Irritant to eyes, nose, throat, dermatitis, headaches, drowsiness, blindness	Colorless liquid; VP: 96 mm; IP: 10.84 eV; FP: 52°F	Absorption Contact Inhalation Ingestion
*Liquinox (used for decontamination)	TLV/TWA: NA	May cause local irritation to mucus membranes	Odorless, nonflammable	Inhalation Ingestion Contact
*Nitric Acid (used in the preservation of samples)	PEL: 2 ppm(5mg/m ³) STEL: 4ppm(10mg/m ³) IDLH: 25 ppm	Eye irritation, irritation to mucus membranes, delayed pulmonary edema, dental erosion	Colorless liquid, non combustible, IP 11.95 eV	Inhalation Ingestion Contact
Dieldrin	PEL: 0.25mg/m ³ skin TLV/TWA: 0.25mg/m ³ [skin] IDLH: Ca [35 mg/m ³]	Convulsions, coma, Carcinogen, liver and kidney damage	Colorless to light tan crystals (insecticide)	Inhalation Absorption Ingestion Contact

Table 6.5. Potential Chemical Exposures

Table 6.5. (continued)

Chemical ^a	TLV/PEL/REL/ STEL/IDLH [*]	Health effects/ potential hazard ^c	Chemical and physical properties ^c	Exposure route(s) ^c
Heptachlor Epoxide	PEL: 0.5 mg/m ³ [skin] TLV/TWA: 0.05 mg/m ³ A3 IDLH: Ca [700mg/m ³]	Carcinogen, tremors, convulsions, liver damage	White to light tan crystals with a camphor-like odor (insecticide)	Inhalation Absorption Ingestion Contact
DDT	PEL: 1 mg/m³ [skin] TLV/TWA: 1 mg/m³ IDLH: Ca	Carcinogen, dizziness, confusion, headaches, fatigue, convulsions, vomiting, irritant to eyes and skin	Colorless crystals or off- white powder with a slight aromatic odor. (pesticide)	Inhalation Absorption Ingestion Contact
Chlordane	PEL: 0.5 mg/m³ [skin] TLV/TWA: 0.5 mg/m³ [skin] IDLH: Ca [100mg/m³]	Carcinogen, blurred vision, confusion, delirium, nausea, vomiting, tremors, convulsions, lung, liver, kidney damage	Amber-colored viscous liquid with a pungent, chlorine-like odor. (insecticide)	Inhalation Absorption Ingestion Contact
PAH's (benzo(a)pyrene)	PEL/TWA: 0.2 mg/m ³ TLV/TWA: A2	Carcinogen, dermatitis	Yellow crystal, VP very low	Inhalation Ingestion Contact
Endrin	TWA: 0.1 mg/m ³ [skin] IDLH: 2 mg/m ³	CNS, liver damage, headaches, dizziness, convulsions	Colorless to tan, crystalline solid with a mild chemical odor (insecticide)	Absorption Inhalation Ingestion Contact
2-butanone (methyl ethyl ketone)	TWA: 200 ppm IDLH: 3000ppm	Irritant to eyes, skin, respiratory system, CNS	Colorless liquid with a moderately sharp, fragrant, mint or acetone like odor, FP: 16°F, IR: 9.54eV	Inhalation Ingestion Contact

Table 6.5. (continued)

Chemical	TLV/PEL/REL/	Health effects/	Chemical and physical	Exposure
	STEL/IÐLH ⁶	potential hazard ^c	properties ^c	route(s) ^c
Naphthalene	TWA: 10 ppm IDLH: 250 ppm	Irritant to eyes, abdominal pain, dermatitis, headaches, confusion	Colorless to brown solid with an odor of mothballs, VP: 0.08mm, IP: 8.12eV	Absorption Inhalation Ingestion Contact

"The potential chemicals were obtained from one or more of the following sources: the WP, groundwater data, operational reports or burial records, soil data, surface water data, and sediment data.

^bFrom 1995-1996 Threshold Limit Values, NIOSH Pocket Guide to Chemical Hazards, 1997.

'From NIOSH Pocket Guide to Chemical Hazards.

A1 - Confirmed Human Carcinogen

A2 - Suspected Human Carcinogen

A3 - Animal Carcinogen

6.5.2 Training

Personnel who participate in field activities associated with this project are subject to the training requirements presented in Table 6.6

Training	Worker	Supervisor	Site visitor
Hazardous Waste Safety (40 hour, 3 day OJT)	×	~	✓
Hazardous Waste Safety Refresher (8 hour)	7	✓	✓
Hazardous Waste Safety Supervisors Training (8 hour)	x	✓	x
First Aid/CPR (Red Cross Equivalent)*	~	✓	x
Site Specific Health and Safety Training	 ✓ 	✓	
Safety Briefing (daily and whenever conditions or	~	✓	x
tasks change)			

Table 6.6 Training Requirements

✓ = Required

x = Not required OJT = on-the-job training

*At least two onsite personnel will be trained in First Aid/CPR

Two versions of the site-specific safety training will be used. The site worker version will contain full information on site hazards, hazard controls, and emergency procedures. A shortened version will be used for visitors who will be on site for short times and who will not do hands-on work. This shortened version will contain the hazard information that is directly relevant to the purpose of the visit. Signatures of those attending and the type of briefing must be entered in the field logbook before site access will be granted. The site-specific training will include the following site-specific information:

names of site health and safety personnel and alternates;

contents of the HSP;

hazards and symptoms of contaminant exposure;

hazards and symptoms of chemicals present in the workplace;

physical hazards in the workplace;

location and availability of written hazard communication program;

site and task PPE (including purpose, donning, doffing, proper use);

safe work practices to minimize risks;

safe use of engineering controls and equipment;

medical surveillance requirements;

site control measures;

reporting requirements for spills and emergencies;

personnel decontamination procedures;

contingency plans (communications, phone numbers, emergency exits, assembly point, etc.);

spill containment procedures (reporting, clean-up methods, etc.); and

emergency equipment locations and use (fire extinguishers, spill kits, etc.).

Safety Briefings will be held when conditions or tasks change and at least daily. These briefings will be conducted by the SHSO and/or operations manager and will be attended by all site workers and supervisors. These briefings will address site-specific safety issues and will be used as an opportunity to refresh workers on specific procedures and to address new hazards and controls.

Documentation of the required training will be maintained in the on-site project files. This documentation will include copies of 40-hour, 8-hour refresher, and supervisor training certificates, copies of medical clearance reports, and entries in project logs showing the topics covered, trainer, and signatures of those attending on-site training.

6.5.3 Medical Surveillance

All employees performing on-site hazardous waste related work will be enrolled in a medical surveillance program to meet the requirements of 29 CFR 1910.120(f) and SAIC EC&HS Procedures 12 (Medical Surveillance) and 20 (Hazardous Waste). This medical surveillance will be documented on site with copies of medical clearance to perform work pursuant to 29 CFR 1910.120.

The frequency of employee medical exams shall be as follows:

- prior to assignment;
- once every 12 months for routine site workers and at least once every two years for workers who make infrequent site visits;
- at termination of employment or reassignment to an area where the employee would not be covered, if the employee has performed field work since his/her last examination and has not had an examination within the last 6 months;
- as soon as possible upon notification by an employee that he/she has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards, or that the employee has been injured or exposed above the PEL or published exposure levels in an emergency situation;

6.5.4 Records

A system of reports and logs will be used to document activities related to site Health and Safety. The following documents will be generated.

- Training logs will contain information covered and the signatures of the trainer and those attending. These logs will contain documentation of pre-entry (project start) training, routine (?tailgate?) safety briefings, and visitor training.
- Safety inspection logs will contain the dates of inspections, identity of the person doing the inspection, the examined areas/activities/equipment, any deficiencies, and any corrective actions taken.
- Employee/visitor register will be a sign-in log for all site employees and visitors. It will contain the names of all personnel who perform on-site work or visit the site. It will not contain the names of delivery or similar personnel.

Environmental and personal exposure monitoring/sampling results will be maintained in a log that will contain monitoring data, location and time of monitoring, types of work being done, calibration records, and the identities of personnel performing monitoring.

6.6 SITE CONTROL

The SHSO will be responsible for establishing the site control zones, as necessary, around SAIC controlled areas that present physical or chemical hazards. Implementation of the site control zones will help to minimize the number of employees potentially exposed and to minimize the potential for the spread of contamination. The SHSO will monitor the implementation of the required site control work rules and will report any deviations from prescribed practice to the Project Manager or stop work, as appropriate.

Site control zones will be established in a number of locations over the site. The exact locations will vary depending on site conditions; therefore, it is not possible to predetermine the size or exact locations of site control zones.

All visitors to the site must sign the visitors log and undergo a health and safety briefing from the SHSO before going onsite documented in the project logbook.

6.6.1 Exclusion Zone

The exclusion (contamination) zone is the area where the greatest potential exists for exposure to contamination or physical hazards. The periphery of the exclusion zone will be identified by barricade tape suspended above the ground. The number of people and equipment in the exclusion zone will be minimized to control physical hazards and the spread of contamination.

The following standard rules will apply to all entry into the exclusion zone.

- The SHSO or Field Operations Manager must approve (and log) entry into the exclusion zone.
- All personnel entering the exclusion zone will wear the prescribed level of protective clothing.
- All items and related paraphernalia intended to be placed on the face or in the mouth (cigarettes, lighters, matches, chewing tobacco, food, cosmetics, etc.) are prohibited in the exclusion zone.
- All personnel in the exclusion zone will follow the buddy system.

Exclusion zones will be established where the spread of contamination is a potential hazard and will be appropriate to the hazard and surroundings.

6.7 CONTAMINATION REDUCTION ZONE

A contamination reduction (buffer) zone will be established, as necessary, outside the exclusion zone to provide a transition from and a buffer between the exclusion zone and the support zone. A formal personnel contamination reduction zone will be established only if Level D+ or respiratory protection is used.

All personnel entering the contamination reduction zone will wear the prescribed level of protective clothing required for that zone. All items intended to be placed on the face or in the mouth (e.g., cigarettes, chewing tobacco, food, cosmetics, etc.) are prohibited in the contamination reduction zone. Doffing of chemical protective clothing, personnel decontamination, and equipment decontamination will occur in the contamination reduction zones.

6.8 SUPPORT ZONE

The support zone is the clean and relatively safe area of the site that surrounds the exclusion and contamination reduction zones. Generally, the support zone is considered to include all the area of a site that is not enclosed within an exclusion or contamination reduction zone.

Work in the support zone requires current hazardous waste safety training, medical surveillance, and use of the buddy system. Note that these requirements do not apply to paperwork or similar activities inside onsite office trailers.

6.9 PERSONAL PROTECTIVE EQUIPMENT

SAIC's PPE program is controlled by EC&HS Procedures 13 and 20 and 29 CFR 1910 Subpart I, Personal Protective Equipment. The SHSO may raise or lower the level of PPE worn by the teams, depending upon the site-specific hazards encountered in the field. Prior to lowering the level of PPE, the Project Manager and the Health and Safety Manager will be contacted/consulted and the results documented. If site conditions are such that the level of PPE is insufficient or work must be stopped, the SHSO will take appropriate action immediately and the appropriate personnel (see above) will be contacted afterwards. Criteria indicating a possible need for reassessment of the PPE selection include the following:

- commencement of an unplanned (hazard not previously assessed) work phase;
- working in unplanned temperature extremes;
- evidence of contamination such as discolored soil or elevated instrument readings near the soil;
- exceeding action limits for exposure; or
- changing the work scope so that the degree of contact with contaminants changes.

6.9.1 Types of Equipment

This section presents the types of protective clothing that may be used for the project. Requirements for task-specific levels of protective clothing are presented in the Hazard Analyses and Controls table (Table 6.4). Levels of protection that may be used to protect against chemical and physical hazards at this site include:

- Level C Protective Equipment
 - full-face respirator and air purifying cartridges capable of filtering dust, organic vapors, and ammonia
 - chemical-resistant clothing (Polyethylene-coated Tyvek® or equivalent)
 - two pair chemical-resistant gloves (nitrile and exam gloves)
 - safety boots
 - shoe covers
 - hard hat (if overhead hazards are present)
- Level D+ Protective Equipment
 - Tyvek® or equivalent coveralls
 - nitrile or polyvinyl chloride (PVC) gloves
 - safety boots
 - boot covers
 - hard hat (if overhead hazards are present)
 - safety glasses with side shields
- Level D Protective Equipment
 - coveralls/field clothes
 - safety boots
 - safety glasses with side shields
 - hard hat (if overhead hazards are present)
 - nitrile or equivalent gloves if contaminated materials are handled

6.10 CLEANING, STORAGE, AND PROGRAM VERIFICATION

If site tasks require the use of chemical protective clothing, disposable clothing will be disposed as specified in the Field Sampling Plan. Used chemical protective clothing will be rendered unfit for further use by tearing or cutting. Unused chemical protective clothing will be stored in clean staging areas until needed. The SHSO will verify that the PPE in use is appropriate and is being used properly.

6.10.1 Monitoring

Assessment of ambient conditions and employee exposures will be performed, as appropriate, to verify that safe conditions are maintained. Action levels, with appropriate actions, have been established for this monitoring. All personal exposure monitoring records will be maintained in accordance with 29 *CFR* 1910.20. The specific minimum monitoring requirements and action levels are presented in Table 6.7.

Air monitoring for volatile organic compounds will be conducted using a photoionization detector (10.2 eV) or flame ionization detector, or equivalent instrument. Although not all volatile organic chemicals can be detected in this fashion, many contaminants can be detected and will serve as indicators of contamination. The action levels for organic vapor measurements have been set conservatively to compensate for the inability of the instrument to detect all site contaminants. Because these action levels are based on the potential to exceed time weighted

average exposure limits; their use requires the application of professional judgment on the part of the SHSO. If breathing zone concentrations of total organic vapors exceed the action level for more than one minute or if frequent short peaks above the action level occur, the activity will be stopped and the SHSO will notify the Field Manager and Health and Safety Manager. Following assessment of the situation, appropriate actions will be taken. These may include identification of the airborne contaminant(s), measures to reduce airborne concentrations, and consideration of the use of respiratory protection. If breathing zone readings decrease to less than the action level, the additional controls may be discontinued. The instrument used to monitor for organic vapors will be calibrated before each day of use, using the technique specified by the manufacturer.

Air monitoring for combustible gasses and oxygen will be conducted using an intrinsically safe combination combustible gas indicator (CGI) if site conditions suggest the potential for flammable concentrations of solvents or other airborne gasses or vapors. Indications of such potential include elevated (>100 ppm) total organic concentration at or near a source or data suggesting that methane may be present such as intrusive work at a landfill or near buried organic material. The 100 ppm (PID) action level requiring initiation of CGI monitoring corresponds to approximately 1 to 2% of the LEL for probable flammable solvent contamination. A PID cannot be used as a trigger for methane measurement because these instruments cannot detect methane. If methane is suspected, the CGI will be used continuously. The CGI will be calibrated daily (each day it is used) using the technique set forth by the manufacturer.

There are no direct real time monitoring equipment for ammonia however, it is a strong irritant at levels below the PEL. If site workers detect irritation from ammonia, work will stop and will proceed in Level C with filters for ammonia. Signs and symptoms of ammonia exposure will be part of the pre-entry safety briefing.

SAIC has conducted sound level measurements of typical site equipment and these data have been used to establish basic hearing protection requirements. Sound levels around drill rigs and generators will be assumed to exceed 85 dBA (requiring hearing protection) unless site-specific sound level measurements indicate otherwise. The sound level meter will be calibrated daily (each day it is used) using the technique set forth by the manufacturer.

6.11 SAFE WORK PRACTICES

This section presents those general safety rules that apply to all operations performed by SAIC and its subcontractors. The provisions of the plan are mandatory for all on-site employees and visitors. This includes employees engaged in initial site reconnaissance, preliminary field investigations, mobilization, project operations, and demobilization.

6.11.1 Site Rules

The following rules apply to all site activities.

- The OSHA poster #2203 will be prominently displayed on site.
- Daily safety briefings ("tailgate") will be held during field activities to inform personnel of new hazards or procedures.

Hazard or Measured Parameter	Area	Interval	Limit	Action	Tasks
Airborne organics with PID or equivalent	Breathing zone (2-3 feet from source or 14 inches in front of employee's shoulder	At least once every 30 minutes during intrusive activities; continuously during elevated readings	<5 ppm >5 ppm (over background)	Level D Withdraw and evaluate -identify contaminants -notify Project Manager and Health and Safety Manager	Drilling, other intrusive tasks
Airborne chemical concentrations (detector tubes)	Breathing zone	If organic vapor >5 ppm	PEL or TLV	Variable, may include engineering, administrative, or personal protective measures	Any indicated by organic vapor instrument readings
Flammability and oxygen content with combustible gas indicator	Near borehole or other source, specifically near Closed Landfill	Continuously at Landfills or any location where PID readings exceed 100 ppm anywhere in the area or other indicators of flammability observed	<10% LEL >10% LEL	Continue and evaluate source. Withdraw and allow area to ventilate; notify Project Manager and H&S Manager	Drilling
Temperature	In or near work area	At least twice a day to approximate highest and lowest temperatures	>70°F <40°F	Administrative controls (See Section 8.16)	All tasks
Noise	Exclusion zone around drilling and equipment decontamination area around generator	Initially. Note that this monitoring is optional. If not conducted, drill rigs and generators will be assumed to exceed 85 dBA.	85 dBA	Require the use of hearing protection	Drilling, Equipment decontamination

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Table 6.7. Monitoring Requirements and Action Limits

LEL = lower explosive limit PEL = permissible exposure limit TBD = to be determined

TLV = threshold limit value

- The SHSO or Field Operations Manager will conduct and document daily safety inspections.
- Personnel will perform only those tasks that they believe they can do safely.
- Personnel will notify the SHSO of any medical conditions (e.g., allergic to bee stings, diabetes, pregnancy) that require special consideration.
- Personnel will maintain proper workplace housekeeping to minimize the potential for trips and other accidents.
- Contact with potentially contaminated substances will be avoided. Site personnel in the exclusion zone will avoid walking through puddles, pools, mud, kneeling on the ground, and placing equipment on the ground.
- All injuries and accidents will be reported to the SHSO, who will perform further notifications.
- All workers in potentially hazardous areas will abide by a buddy system. Members of a buddy team will maintain radio, verbal or visual contact.

6.11.2 Permit Requirements

SAIC will obtain or coordinate with Scotts to obtain all permits necessary for the safe execution of this project. As a minimum, this will include digging permits/clearance from local utilities prior to any drilling, excavation, etc.

6.11.3 Drum/Container Handling

No drums of unknown material will be addressed as part of this project. Any drums used for the project will meet Department of Transportation requirements and will be labeled to comply with applicable U.S. Environmental Protection Agency (EPA) requirements. If it becomes necessary to address drums of unknown material, this work will be done in accordance with 29 CFR 1910.120(j).

6.11.4 Confined Space Entry

Any confined space entry will be performed in conformance with the requirements of SAIC EC&HS Procedure 10 and 29 *CFR* 1910.146. No confined space entry is planned for this project.

6.12 HOT WORK, SOURCES OF IGNITION, FIRE PROTECTION

- Hot work (oxyfuel cutting) will be conducted using welder's helmet or shaded goggles, leather gloves, and a long-sleeved shirt.
- A fire extinguisher rated not less than 10-ABC will be immediately available in the vicinity of hot work.

- Sources of ignition will be kept at least 15 meters from flammable storage areas.
- Flammable storage areas will be posted with signs indicating "No smoking or open flame".
- At least one fire extinguisher with a rating of not less than 20-B will be kept 8 to 23 meters from all flammable storage areas.
- An approved flammable cabinet will be used to store 25 or more gallons of flammable liquid if the flammable liquid is stored indoors.
- Flammable liquids will be kept in safety containers with flame arresters or in the original container.

6.12.1 Electrical Safety

This work will be conducted in conformance with 29 CFR 1910, Subpart S.

- All portable electrical equipment will be double insulated or grounded and connected through a ground fault circuit interrupter.
- Conductive materials (drill rigs) will be kept clear of energized power lines. The following minimum distances will be observed; 0-50 kV 3.1 m; 51-100 kV 3.66 m; 101-200 kV 4.57 m; 201-300 kV 6.1 m; 301-500 kV 7.62 m; 501-750 kV 10.67 m; 750-1000 kV 13.72 m.

6.12.2 Machine Guarding

All equipment will be operated with all guards provided by the manufacturer and in compliance with 29 *CFR* 1910, Subpart O. If any guarding must be removed for servicing, the equipment will be disabled to preclude movement or release of energy.

6.13 LOCKOUT/TAGOUT

All potentially hazardous servicing or equipment repair will be governed by the SAIC EC&HS Procedure 11, Lock Out/Tag Out, and 29 *CFR* 1910.147. No such activities are anticipated for this project.

6.14 FALL PROTECTION

Work areas with the potential for a fall of 1.2 meters or more will be provided with fall protection. This fall protection will consist of guardrails or personal fall protection. Personal fall protection will be used if it is necessary for drilling personnel to climb the upright mast or derrick.

6.15 ILLUMINATION

Routine fieldwork will be conducted during daylight hours (no earlier than 15 minutes after sunrise and no later than 15 minutes before sunset) and natural illumination will be used. Any work conducted during non-daylight hours will be illuminated to meet the following minimums

stated in 29 CFR 1910.120(m): general work areas, 5 foot-candles; stairs and ladders, 10 foot-candles; offices, 50 foot-candles; and first aid areas 30, foot-candles.

6.16 SANITATION

Sanitation will comply with 29 CFR 1910.120(n).

- Means for washing hands and faces prior to eating will be provided at the work site.
- Potable drinking water will be provided in labeled, sanitary dispensers.
- Toilets (if not accessible on site) shall be provided according to the following; #20 employees = 2 toilets, 21 to 199 employees = 1 toilet seat and 1 urinal per 40 workers.

6.17 HEAT/COLD STRESS

Important factors in preventing heat stress induced illnesses are acclimatization, consumption of copious quantities of fluids, and appropriate work/rest cycles. General controls will consist of making fluids readily available, use of the buddy system, and taking scheduled and unscheduled breaks in temperature controlled areas as necessary. The following specific steps will be taken to reduce the potential for heat stress induced illness.

- If ambient temperatures exceed 70°F, site training will include heat stress control, recognition of heat stress induced illness, and first aid for heat stress.
- If ambient temperatures exceed 70°F, cool Gatorade or equivalent drink (mixed at 4 parts water to 1 part concentrate) will be made conveniently available to site workers.
- If ambient temperatures exceed 70°F, workers will be instructed to monitor their own and their buddy's condition relative to heat stress.
- Workers will be allowed to take unscheduled breaks, if needed.
- A formal work/rest cycle will be established by the SSHO if workers are wearing Tyvek or similar coveralls at temperatures greater than 85 F. The temperature will be measured with a dry bulb thermometer placed in the same conditions experienced by the workers. The work cycle will require that all the employees in a crew take regularly scheduled breaks in a cooler area. Following initial implementation, this schedule may be adjusted by the SHSO based on worker pulse rates, the physical condition of workers, or the nature of work. Decreases in the protection offered by this schedule must be approved by the project manager and H&S Manager. The following table presents requirements for the amount of work and rest in each hour. Note that the cycle is based on assumption of light work (taking notes, walking, light lifting) and adjustments must be made if some members of a team (for example, a driller's helper) are performing more strenuous work. It may be necessary for some members of a crew to be on a different (shorter) cycle. The following table presents the work rest cycle.

Temperature	Work Per Hour	Rest Per Hour ^a
<85°F	Continuous work	
<87°F	45 min.	15 min.
<89°F	30 min	30 min
<91°F	15 min.	45 min.
>91°F	Consult H&S Manager	

^aThis information is based on a modification of the proposed heat stress TLV presented in the 1998 ACGIH TLV Booklet. The TLV has been modified to address the use of impermeable clothing by assuming no evaporative cooling and removing the influence of the wet bulb thermometer in the Wet Bulb Temperature Index.

Critical factors in preventing cold stress disorders are adequate clothing and staying dry. The SHSO and Field Operations Manager will ensure the capability to quickly move individuals who become wet to a sheltered, warm area. The following specific steps will be taken [adapted from American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values booklet].

- If ambient temperatures are less than 40°F, site training will include prevention of cold injury, cold injury symptoms, and cold injury first aid.
- A heated break area will be provided if ambient temperatures are less than 32°F.
- As a minimum, breaks will be taken in a warm area every 120 minutes if ambient temperatures are less than 32°F.
- Workers will be allowed to take unscheduled breaks, if needed, in a warm area.
- No outdoor work will be performed if the equivalent chill temperature (temperature combined with the effect of wind) is less than -29°F

6.18 DECONTAMINATION PROCEDURES

6.18.1 Chemical Contamination Avoidance

One of the most important aspects of decontamination is the prevention of contamination. Good contamination prevention should minimize worker exposure and help ensure valid sample results by precluding cross-examination. Procedures for chemical contamination avoidance include:

- Do not walk through areas of obvious or known contamination.
- Do not directly handle or touch contaminated materials.
- Make sure that there are no cuts or tears on PPE.
- Particular care should be taken to protect any skin injuries.
- Stay upwind of airborne contaminants.
- Do not carry cigarettes, cosmetics, gum, etc., into contaminated areas.
- When required by the SHSO, cover instruments with clear plastic leaving openings for sampling ports.
- Care should be taken to limit the amount of contamination that comes in contact with the sampling equipment (soil probes, tires, etc.).

If contaminated tools are to be placed on non-contaminated equipment for transport to a decontamination area, plastic should be used to keep the equipment clean.

6.18.2 Equipment Decontamination

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Sampling equipment used during the project that is potentially contaminated will be decontaminated to prevent migration of hazardous material outside the site. Decontamination procedures are found in the Work Plan.

6.18.3 Personnel Decontamination

A system of procedures will be used to control the spread of contamination from the exclusion (contamination) zone and to ensure that workers are sufficiently free of contamination to preclude adverse health effects. PPE doffing and personnel decontamination are part of this system. This section presents basic requirements for personnel decontamination keyed to the level of protection. These requirements may be modified by the SHSO if improvements are needed. See the Hazards Analysis section for task-specific PPE.

6.18.3.1 Level D Protection Decontamination

Station 1: Removal of disposable gloves and boot covers, if worn

Deposit disposable gloves and boot covers in a designated container. Note that this step is necessary only if gloves and boot covers are in use.

Station 2: Field wash

Wash face and hands prior to taking anything by mouth. This may be done with soap and water or disposable disinfectant towels.

6.18.3.2 Level D+ Protection Decontamination

Station 1: Tape removal

Remove all tape (if used) from outer clothing and place in appropriate waste container.

Station 2: Boot covers, outer disposable garment, and gloves removal

Carefully remove boot covers, outer contamination-resistant garment, and gloves.

Station 3: Field wash

Wash hands and face prior to eating, drinking, smoking, etc. This step may be accomplished with soap and water or disposable disinfectant wipes.

6.18.3.3 Level C Protection Decontamination

Station 1: Segregated equipment drop

Deposit equipment used on site (tools, sampling devices, containers, monitoring instruments, clipboards, etc.) on plastic sheets or in different containers with plastic liners. Segregation of the equipment at the drop site reduces the possibility of cross-contamination.

Station 2: Outer boot and glove removal

Remove tape from outer boots and outer gloves. Remove outer boot covers and outer gloves. Deposit gloves and boot covers in plastic trash bags.

Station 3: Cartridge change

If a worker has left the exclusion zone for the sole purpose of changing a canister/cartridge of the respirator, this is the last step of the decontamination procedure. Once the worker's canister/cartridge has been replaced, the outer boots and gloves will be replaced and retaped so that all potential pathways to the skin are sealed.

Station 4: Disposable outer garment removal

Remove disposable outer garment, deposit in a plastic trash bag, and dispose in accordance with applicable state and local requirements.

Station 5: Respiratory protection and disposable inner glove removal

The respirator is the next-to-last item for removal. The cartridges/canisters are placed in a plastic trash bag and disposed of in accordance with the project Field Sampling Plan. The respirator is placed in a plastic bag dedicated for used respirators only. Remove disposable inner gloves last and deposit them in a plastic trash bag.

Station 6: Field wash

Wash hands and face prior to eating, drinking, smoking, etc. This step may be accomplished with soap and water or disposable disinfectant wipes.

6.18.3.4 Emergency Decontamination

If emergency life-saving first aid and/or medical treatment are required, normal decontamination procedures may need to be abbreviated or omitted. The emergency takes precedence over any contamination. The SHSO or designee will accompany contaminated victims to the medical facility to inform medical personnel what chemicals are involved. For minor medical problems or injuries, the normal decontamination procedures will be followed.

6.19 EMERGENCY PLAN

The Field Operations Manager or SHSO will remain in charge of all SAIC and subcontractor personnel during emergency activities. The Field Operations Manager will perform emergency notification of emergency medical services, fire department, SAIC Project Manager, SAIC Health and Safety Manager, etc. In order to minimize the potential for accidents and injuries, daily safety and health inspections will be conducted by the Field Operations Manager or SHSO. If an emergency occurs, the Field Operations Manager, the SHSO, and the field team will participate in a briefing to discuss the event, identify the causes, identify corrective measures, and evaluate the responses.

In the event of an accident or incident, the Field Operations Manager or SAIC Project Manager will notify the EECG H&S Manager (and appropriate additional EECG managers) and Scotts Environmental Coordinator, Rebecca Clarridge, and Scotts Security. A SAIC Supervisor's Accident Form will be completed.

All personnel working on site will be trained in the requirements of this section. This will include recognizing emergencies, reporting emergencies to the Field Operations Manager or SHSO, and responding to emergencies. Employees will also be informed of any changes in potential emergencies or response plans.

6.19.1 Potential Emergencies

Credible potential emergencies for this project includes fires, minor chemical spills, and personnel injury.

6.19.1.1 Fires

Small quantities of flammable solvents (typically less than 5 gallons), gasoline, and diesel fuel will be present on site. In the event of a fire, the local fire department will be notified immediately. If it is safe to do so, on-site personnel will attempt to extinguish the fire with the available fire extinguishers and isolate any nearby flammable materials. If there is any doubt about the safety of extinguishing the fire, site personnel will evacuate the area. The supervisor or knowledgeable employee will provide the fire department with relevant information when they arrive.

6.19.1.2 Spills

Potential spills include releases of fuels, lubricants, hydraulic fluids, and decontamination solvents. In the event of a spill or leak, the employee making the discovery will immediately notify the SHSO and/or the Field Operations Manager. The Field Operations Manager will determine whether the leak poses an environmental risk or will exceed the capacity of on-site personnel and equipment. In the unlikely event that there is a probability that the spill will extend beyond the immediate area, result in an environmental insult, or exceed the capabilities of the on-site personnel, the Field Operations Manager will inform the local fire department and hazardous materials response team. If this is not the case, the on-site spill kit will be used to clean up the spill.

6.19.1.3 Medical Emergencies

Field crews will use a variety of equipment that could cause injuries. In the event of a medical emergency, the Field Operations Manager will notify the local emergency medical service immediately. The route map to the hospital will be prominently posted on site. At least two first aid/CPR-trained individuals will be on site at all times and these personnel will provide first aid pending release of the injured person to emergency medical staff. Contaminated injured personnel will be decontaminated to the extent feasible. Personnel with minor injuries will follow normal decontamination procedures. Personnel with serious injuries will be decontaminated, if necessary, by disrobing and wrapping in a blanket. Decontamination may be bypassed in the event of life-threatening injuries or illnesses.

6.20 EMERGENCY PHONE NUMBERS

Listed below are emergency groups and their telephone numbers. This list will be prominently posted at the site. A telephone will be present in the field and available for use.

The Scotts Company	937-644-0011
Security	ext. 7274
Director of Environmental Engineering- Gary Duagherty	ext. 7511
Environmental Coordinator – Rebecca Clarridge	ext. 7066
Hospital: Memorial Hospital	
500 London Avenue, Marysville, OH	937-644-6115
Fire Department	911
209 S. Main Street, Marysville, OH	937-642-2065
Police/Rescue Squad	911
12 East Sixth Street, Marysville, OH	937-642-3960
EEMG Health and Safety Manager	
Steve Davis	423-481-4755

6.21 EMERGENCY ALERTING

Each team will have a means for generating an audible alarm, which will consist of a compressed gas horn or vehicle horn. These devices will be used to signal to other project personnel in the event of accidents or emergencies. Short blasts (less than 1/2 second) of the horn will be used to request assistance, while extended blasts (more than 2 seconds) will signal an evacuation.

6.22 EVACUATION

The SHSO or Field Operations Manager will designate the evacuation routes and an assembly area. All employees will be familiar with the evacuation routes and assembly area.

6.23 EMERGENCY EQUIPMENT

Several items of emergency equipment will be maintained at the work site. Any incident that is not clearly controllable by personnel wearing standard site clothing plus protective gloves and using the listed equipment will require reevaluation by the SHSO. If the SHSO does not feel that on-site personnel can safely control the emergency with the available equipment the crew will use alternate approaches such as allowing a small fire to burn out or evacuating the site. The required emergency equipment includes:

- 16-unit first aid kit indoors or in weatherproof container, inspected weekly;
- compressed gas horns;
- 15 minute emergency eye wash to meet American National Standards Institute standard within 100' of any area where corrosives (water sample preservatives) are being poured;
- fire extinguisher(s) (at least 20-B) 8 to 23 meters from outside flammable storage (or use) area;
- basic spill kit suitable to handle small spills of decontamination fluids, hydraulic fluid, or fuels and containing sorbent pads, tubes, and nitrile or similar gloves; and
- telephone.

6.24 ADVERSE WEATHER CONDITIONS

In the event of adverse weather conditions, the SHSO or designee will determine if work can continue without compromising the health and safety of field personnel. Some of the items to be considered prior to determining if work should continue are the following:

- potential for cold stress and cold related illnesses,
- treacherous weather-related working conditions, and
- potential for electric storms/dust storms.

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Section 7 DATA MGM. PLAN

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# DATA MANAGEMENT PLAN

# **SECTION 7**

# **RCRA FACILITY INVESTIGATION WORK PLAN**

# FOR

THE SCOTTS COMPANY 14111 Scottslawn Road Marysville, Ohio 43041

June 11, 1999

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#### 7.0 DATA MANAGEMENT PLAN

#### 7.1 INTRODUCTION

This document is part of the RCRA Facility Investigation (RFI) Work Plan for the activities at The Scotts Company, Marysville, Ohio. The RFI is being conducted to evaluate the environmental impact of Landfill Nos. 1 through 5; Field Broadcast Area (FBA) Nos. 1 and 2; Former Ponds No. 2, 3, 6, 7, and 8; and Crosses Run.

The Data Management Plan (DMP) is an integral element of the RFI Work Plan. The DMP has been developed for the purpose of documenting, tracking, presenting, and maintaining the investigation data and results.

#### 7.2 DATA DOCUMENTATION AND TRACKING

The information to be documented and tracked includes records of field activities and field measurements, sample custody records, records of laboratory activities related to project-specific samples, and the laboratory data generated from their analysis.

#### 7.2.1 Field Activities Records

A program designed to ensure that field-performed analyses yield valid, useful data is summarized in Table 1. In all cases, the field team will maintain a concise, detailed field logbook containing pertinent field activities and actions taken as well as documentation of observations made.

Sampling procedures, instrument calibration, and information pertinent to sampling conditions, progress, and field data collection will be documented following a prescribed set of guidelines. The documentation serves as a permanent and traceable record of all activities related to a specific field investigation project. The record must be legible and accessible to allow ease in verifying sampling activities and addressing future questions, which may arise concerning such issues as sample integrity, sample traceability, etc. All documentation generated during the field investigation program will be kept in the project files upon completion of fieldwork.

#### 7.2.1.1 Sample Designation/Identification

The establishment of a standard sample designation/labeling protocol is essential to ensure adequate quality assurance/quality control (QA/QC) in regards to the traceability of samples and their associated analytical data. Proper labeling allows for the tracking of samples beginning from the time of sample collection, through analysis, and following project completion. The proper labeling of samples is also critical in ensuring that samples are analyzed within the required sampling holding times. A sample label will be affixed to each sample container and will provide the following information:

- Project Name
- Sample ID
- Sample Collection Date and Time

- Laboratory
- Sample Matrix
- Analytical Parameters
- Analytical Method(s)
- Container and Preservative
- Sampler(s)

All samples will be identified using a unique sample identification scheme suitable to the project and the sampling protocol. The numbering scheme will be devised by the data management team and the field sampling team, and approved by the project manager prior to sampling activities. The sample identification number will be recorded on the chain-of-custody (COC) and on each sample submitted to the laboratory for analysis.

# Table 7.1Field Sampling Team Documentation Objectives to<br/>Ensure Valid Data Collection

| Objective                         | Action                         | Responsible Person              |
|-----------------------------------|--------------------------------|---------------------------------|
| Verify that sample and location   | Review labeled samples and in- | Field sampling team             |
| information conforms to           | process samples using daily    |                                 |
| conditions and requirements       | sample inventory               |                                 |
| specified                         |                                |                                 |
| Verify incoming field data and    | Maintain daily count of        | Field sampling team             |
| sample completeness               | incomplete items               |                                 |
| Verify completeness of field log  | Review daily                   | Field team leader (or designee) |
| books                             |                                |                                 |
| Review field calibration criteria | Perform as necessary           | Field team leader (or designee) |
| and record test calibration       |                                |                                 |
| acceptance                        |                                |                                 |
| Ensure that all data forms are    | Review and check off during    | Field team leader (or designee) |
| properly completed                | each sample collection         |                                 |
| Verify that all field-generated   | Review requirements and        | Field team leader (or designee) |
| QC samples were collected as      | confirm sample collection      |                                 |
| required                          | -                              |                                 |

#### 7.2.1.2 Corrections to Documentation

All field documentation must be recorded in permanent ink. Corrections to errors in documentation or recorded calculations will be made by first striking out the error with a single line so as not to obliterate the original entry. Then the replacement entry or value will be inserted where appropriate. The person originating the change will initial each separate change.

#### 7.2.1.3 Photographs

The project management staff or the field team leader will document, through the use of color photographs where possible, various on-site activities and sampling specifics as deemed necessary for the project. A photographic logbook will be maintained to ensure accurate photographic descriptions upon film development. The photographic logbook will contain the date the photograph was taken and a brief description of the photographic image. Examples of items that may require photographic documentation include:

- General site topography
- Sampling locations
- Drilling/sampling procedures
- Physical appearance of environmental samples

#### 7.2.1.4 Records

Data records will be completed to record all field investigation activities and results. The field team leader has the responsibility of maintaining the daily field documents pertaining to sample identification and control. Special emphasis will be placed on sample control and the completeness and accuracy of field logbooks. Field logbooks, field data forms, and COC forms will contain legible, accurate, and inclusive documentation of project activities. Collectively the logbooks and forms will serve as a diary in which all pertinent project activities will be recorded. This recorded information will be used as the basis in any project reporting and will be subject to review. For these reasons all written language should be objective, factual, and free of personal interpretations or other terminology that may prove inappropriate. All entries made on field logbooks, field data forms, and COC forms will be made with permanent ink.

**Field Logbooks.** A field logbook will be maintained by each field team. The logbook will be comprised of a bound book with consecutively numbered pages; no pages will be skipped when filling in the logbooks. The integrity of field documentation is further ensured by the use of field logbooks containing paper treated to repel the rain or any other aqueous splashing experienced during field documentation. Should more than one field logbook be required, they will be numbered sequentially.

The front of each field logbook typically contains the following information:

- Project name and number
- Types of field activities recorded in the contents of the logbook
- Date(s) of use
- Names of field team members.
- Table of Contents

The field logbook will contain descriptions of all pertinent field activities. The following list contains some standard information typically recorded in field logbooks:

- Date and time of personnel entries on-site, weather conditions and temperature.
- List of start/stop times of all subcontractors hired for activities such as Geoprobe® drilling, monitoring well drilling, surface water sediment sampling, etc.
- List of the personnel present on-site during each sampling day to include all project personnel, subcontractors, and visitors.
- List of the equipment decontaminated along with a reference to the procedures used.

- Description of the sampling locations in reference to permanent landmarks.
- List of any changes from standard operating procedures, decisions made in the field, and other pertinent information.
- QC samples associated with the samples collected, and QC sample collection procedures.
- Equipment and/or instrument identification numbers (if available) for those used.
- Sample preservation techniques performed.
- Level of personnel protection mandated (e.g., Level B, C, and D) and record of pertinent time intervals spent by each field team member at each level (e.g., time spent in Level D developing a well).
- Other logs/paperwork used to document activities.
- Instrument calibration information including the instruments calibrated during the day and the individual who performed the calibration. (Note: Instrument calibration information should be documented in the field logbook as well as on the instrument calibration log kept with each instrument and serving to document instrument response over time).
- List of the samples collected by media (i.e., soil, groundwater, etc.).
- Comments relative to any problem areas that occurred during the day's activities, their final resolution, and any anticipated impact on the outcome of the field investigation.
- All variances from the procedural and other project requirements that have major impacts on costs, schedule, and/or technical performances. Documentation will include reasons why variance is required and what impacts is likely to occur.

Field Data Forms. Along with the completion of data entry in each of the above-mentioned logbooks, field data forms may also be completed and filed in a notebook that is maintained for different field activities. Examples of forms to be used during field investigations are provided in Appendix A.

The forms typically include the following:

- Site Health and Safety Log(s) to maintain accurate health and safety records for each team member (See the Health and Safety Plan)
- Soil Boring Log(s) to document soil boring operations (Appendix A)
- Monitoring Well Construction Diagram(s) to document monitoring well installation and construction (Appendix A)

**Chain-of-Custody**. Possession of samples will be traceable from the time a sample is collected until it is used as evidence in legal proceedings, if applicable. To adequately track sample possession, a documented COC must be maintained. An example COC is included in

Appendix A. See the Quality Assurance Project Plan (QAPP) for more detailed guidelines concerning sample custody procedures in the field and at the laboratory.

## 7.2.2 Laboratory Records

Following documentation of the receipt of samples in the laboratory, samples are tracked from storage through the analytical system until analysis is complete and the samples are sent for disposal. Samples are tracked by the unique laboratory sample number. Laboratory procedures are described in the Laboratory QAPP.

Laboratory records will include the documentation of sample tracking and custody, all relevant instrument calibrations and maintenance, all project-specific sample preparation and analysis, raw data and benchsheets, calculations performed, corrective actions required, and a copy of the final data packages. Details on laboratory records are contained in the QAPP.

# 7.3 DATA VERIFICATION AND VALIDATION

All field and analytical data generated during investigation activities will be reviewed for accuracy and completeness to ensure its validity prior to use in interpretation of site conditions. The following sections present a brief description of methods used for ensuring the use of valid data.

## 7.3.1 Field Data

Following completion of field activities at a sampling location, the field team leader will review all associated field records and documentation for completeness and accuracy. Completed and verified field records will be maintained in the project files. The project data management team will further review all field records to ensure compilation of all generated field data and to verify completion of all field tasks.

# 7.3.2 Analytical Data

Analytical data generated by the laboratory will be validated by the project analytical data validator to ensure that the laboratory followed proper methodology and that reported analytical results are acceptable. Analytical data validation procedures are discussed in the QAPP. Validated analytical records will be maintained in the project files. Validation codes assigned to analytical results will be entered into an electronic database used for analytical data storage and management. The database will be verified for accurate and complete data entry.

# 7.4 ELECTRONIC DATA TRACKING AND STORAGE

Electronic database formats will be used to track, store and manage data generated during investigation activities. The databases will be designed to store large quantities of data as well as to efficiently meet data retrieval needs for presentation of investigation results. The following sections briefly describe the types of information to be managed.

#### 7.4.1 Field Data

Details concerning sampling activities will be maintained in an electronic database designed to track the progress of planned investigation tasks. All planned sampling locations including soil borings and wells, as well as sediment and surface water sampling points, will be entered into the database prior to start of field activities. Information from each sampling location will be tracked and updated to provide real time progress reports to project management. Information to be tracked and managed include such items as sample identifications, sample matrices, sample collection dates, analytical parameters, samplers, COC numbers, and associated logbooks.

#### 7.4.2 Analytical Data

Analytical data from sampling activities will be managed in a database format by the project data management team. To expedite data entry procedures, all analytical results will be received in electronic format from the laboratory. The electronic files containing the sampling data will be loaded into a database designed to track, manage and store sample analytical results. The database will also be used to store data validation results. Data validation codes assigned by the project data validator will be entered into the analytical database.

# 7.5 **PROJECT FILE REQUIREMENTS**

The project files will be maintained to record and track the progress of all project tasks and deliverables. The project files will contain pertinent information concerning project management, field activities, analytical performance, and project reports.

#### 7.5.1 Project Management Records

The project file will include pertinent project management information that may include, but not be limited to, meeting notes, schedules, memorandums, and project correspondence.

#### 7.5.2 Field Data

The project file will include all field sampling records and forms, field logbooks, and health and safety records.

#### 7.5.3 Analytical Performance

The laboratory will maintain a file of all records of laboratory activities, including sample log-in and tracking records, sample storage conditions, all records pertaining to preparation and analysis of project samples, analytical raw data, and a copy of the final data package. The project manager will include the data package and data quality assessment records in the project file.

#### 7.5.4 Project Reports

All project reports including project updates and site investigation documents will be maintained in their final form in the project files. Associated tables, figures, and appendices will also be maintained in the project file. Draft reports will be maintained in the project files until approval of the final report submittal.
Section 8 BRA METHODOLOGY

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# **BASELINE RISK ASSESSMENT METHODOLOGY**

# **SECTION 8**

# **RCRA FACILITY INVESTIGATION WORK PLAN**

## FOR

THE SCOTTS COMPANY 14111 Scottslawn Road Marysville, Ohio 43041

June 11, 1999 (Revised March 21, 2000)

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#### 8.0 BASELINE RISK ASSESSMENT METHODOLOGY

#### 8.1 INTRODUCTION

The scope of the risk assessment at the Scotts Company facility is to characterize the risk to human and ecological receptors both onsite and offsite from contamination in Landfills 1 through 5, Field Broadcast Areas 1 and 2, Pond No. 2 Former Ponds Nos. 3, 6, 7, and 8, and Crosses Run. Results of the risk assessment will be used to determine the need for remedial action at these twelve Solid Waste Management Units (SWMUs) and in Crosses Run [i.e., the thirteen investigative units (IUs)]. The risk assessment will examine the presence of chemical contaminants from the source areas under investigation, the observed levels of the substances in the environment, the potential routes of exposure to human and ecological receptors, and the likelihood of adverse effects following contact with the contaminants.

The methods presented in this work plan provide a general outline of the procedures that will be used to conduct the risk assessment for the Scotts Company facility. Once sufficient site data have been collected, more specific procedures for the risk assessment including algorithms, exposure parameters, and exposure data will be presented in a Technical Memorandum. This Technical Memorandum will be issued prior to conducting the risk assessment in order to obtain concurrence on the risk assessment methodology from the regulatory agencies prior to preparing the risk assessment. Early concurrence on the risk assessment methodology will limit the need for report revision following regulatory agency review and avoid delays in completing the RCRA Corrective Action process for the SWMUs. The methods used to characterize risk at the Scotts Company facility will be consistent with U.S. Environmental Protection Agency (EPA) and Ohio Environmental Protection Agency (OEPA) guidance. Guidance documents include, but are not limited to:

- Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A), EPA 540/1-89/002, December, 1989, PB90-155581;
- Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part B and Part C), EPA 540/R-92/003 and EPA 540/R-92/004, December, 1991;
- Exposure Factors Handbook (EPA 1997);
- Dermal Exposure Assessment; Principles and Applications (EPA 1992a);
- Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure, Preliminary Review Draft (EPA 1993a);
- Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual, Interim Final (EPA 1989b);
- Guidelines for Ecological Risk Assessment, Risk Assessment Forum, US EPA, Washington, DC (EPA 1998);
- Soil Screening Guidance, Technical Manual, (EPA 1996c);

#### 8.2 DATA ANALYSIS AND SCREENING

Data collected in all previous site investigations will be evaluated to determine the usability of the data for risk

assessment. These data include but are not limited all samples collected by Scotts Company, Burgess and Niple, and Ohio EPA. The evaluation and use of existing data will reduce the need for additional data collection and will thereby reduce costs and time required to complete the RFI. In addition, any additional samples collected by SAIC will be included in the risk assessment. Sample results from the SAIC site investigation will be verified and validated using the methodology described in the Quality Assurance Project Plan (QAPP).

#### 8.2.1 Background Screening

Media-specific background data will be used in the remedial investigation to evaluate the nature and extent of contamination and in the risk assessment to select human health contaminants of potential concern (COPCs) and ecological COPCs. Background consists of naturally occurring inorganic constituents. Background results will be used to determine if constituents are present at the Scotts Company facility and adjacent areas as a result of site activities.

#### 8.2.2 Statistical Methodology

Background criteria for all affected media will be calculated according to the statistical methods for background presented in Ohio EPA's closure plan review guidance for RCRA facilities (Ohio EPA 1999). For example, for normally distributed data sets, the background concentration will be defined as the mean value plus two standard deviations of the background data. If there are less than 15% nondetects, one half the detection limit will be used as long as the data meets a normality test, such as a Shapiro-Wilk or a Kolmogorov-Smirnov test. A box and whiskers plot and a normal probability plot will be completed for each data set. If the number of nondetects is greater than 15% but less than 50%, for normally distributed data, Cohen's method will be used to determine sample mean and variance (standard deviation) in order to proceed with a t-test, or 95% confidence limit test. If the data can not be normalized, nonparametric statistics such as Wilkcoxon rank-sum test or test of proportions will be used. If the nondetects are higher than 50% or there are fewer than 12 samples, then the maximum concentration above the detection limit will be used.

The statistical analysis of background and onsite data will be used to compare media-specific background concentrations and onsite concentrations for each detected compound. Analytes with no detection greater than the background concentration will be considered naturally occurring and not related to past waste disposal activities at the site.

#### 8.2.3 Weight-of-Evidence Screens -

Because of inherent problems in applying a single statistical tool to data sets that have different characteristics, an additional screening step will be applied to the data after they have been subjected to the background screen. This screening step is referred to as a weight-of-evidence screen; that is, multiple types of evidence are considered to determine whether a chemical is site-related or naturally occurring. This screen will be applied to chemicals that, based upon review of the sampling results, should be more carefully scrutinized because of site-specific issues that need to be addressed. For example, naturally occurring metals may be present at concentrations near the analytical detection limit, making it difficult to evaluate, or a chemical may not have site-related background concentration. Therefore, other data may be used to evaluate if the concentrations are within normal background ranges. The weight-of-evidence screens that will be used to further evaluate the data are described below.

• Some metals compounds that are present naturally in the environment may be present at concentrations at or near analytical detection limit. This issue will be evaluated if it occurs with the Scotts Company facility database.

- If site-related background concentrations are not available, regional or OEPA background studies may be reviewed for usability in defining background ranges. Depending on the applicability of the data, it will be used either quantitatively or qualitatively as a weight-of-evidence screen.
  - Because the background concentrations will correspond to an upper-percentile (97.72th percentile for normally-distributed data) of the background data (not the full range), it is possible to observe occasional hits above the background concentration that are still within the range of background. A review of the analytes with a low frequency of detection above the background criteria will be performed. If a single detection is greater than the background concentration or the compound is detected at levels that are only slightly above the background screening value, the compound will be evaluated as to whether it is significantly above background or within the expected range of variation of the data set.

#### 8.3 HUMAN HEALTH RISK ASSESSMENT

#### 8.3.1 Identification of Contaminants of Potential Concern (COPCs)

Inorganic compounds will be evaluated as a potential COPCs if detected above background concentrations. All organic compounds will be considered COPCs and included in the risk assessment. Compounds that are essential human nutrients may be excluded as COPCs. These chemicals are not considered hazardous to humans and are essential components of the human diet. Therefore, the concentration of these compounds will be evaluated to determine if they are present at levels that exceed levels that indicate they may contribute to risk at the site. If they do not exceed these levels, they will be excluded from the human health risk assessment.

#### 8.3.2 Exposure Assessment

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The exposure assessment will be performed in two steps. The first step will be to identify any potentially complete pathways between the contaminant source and potential receptors. This involves identifying potential current and future receptors, release mechanisms through which contamination may come in contact with the receptors, and the routes of exposure through which the receptors may be exposed. Current and future receptors will be identified based on the current and projected future use of the site and surrounding land use. Receptors will be identified based on activities that occur or may occur at the site and will consider accessibility to the site and proximity of surrounding population groups. Characterization of receptor populations will consider:

- characteristics of populations living or working near the site including any sensitive subpopulations (children, elderly),
- activity patterns of populations on or near the site,
- frequency and duration of on-site events including consideration of seasonal impacts, on-site restrictions (fencing, security restrictions) and accessibility of the site.

Current and projected land use within the boundaries of the Scotts Company facility is industrial. There is park on the facility that is used for recreational activities. Surrounding land use is agricultural and residential. Table 7.1 summarizes the potential receptors, media, and exposure pathways that will be evaluated for the Scotts Company facility. These receptors and pathways will be reevaluated once all site data are collected and analyzed. The second step in the exposure assessment will be to quantify the exposure for each receptor resulting from contact with contaminated media. In order to quantify exposure for each receptor, an exposure point concentration, or the chemical concentration a receptor is likely to come in contact with over the duration of exposure, will need to be estimated. Receptors may be exposed to chemicals by contact with site media or as the result of chemical migration away from the source into other media.

The U.S. EPA (EPA 1989a) provides the basic methodology for determining pathway-specific intakes. Chemical-specific intakes will be calculated for each receptor population identified at the site and for each media-specific exposure pathway based on the generic intake equation below:

$$I = \frac{(C)(CR)(EF)(ED)}{(BW)(AT)}$$

where:

- I = intake (mg/kg body weight-day)
- C = chemical concentration (i.e., mg/kg)
- CR = contact rate; the amount of contaminated medium contacted per unit time or event (i.e. liters/day)
- EF = exposure frequency (i.e., days/year)
- ED = exposure duration (i.e., hours/day)
- BW = body weight (kg)
- AT = averaging time; period over which the exposure is averaged (days)

Exposure from direct contact pathways represents exposure via direct contact with the source media. For direct contact pathways, the exposure point concentration is the concentration source term (EPA 1992c) and is represented by data collected at the site. Site-specific data will be used to determine exposure parameters for the risk assessment, when available. If site-specific data is not available, exposures will be estimated using standard exposure equations and standard parameter values identified for various exposure conditions (EPA 1989d, 1992a, 1997).

Exposure pathways that incorporate chemical migration to a secondary media (groundwater, surface water, sediments, air, and biota) or to an off-site receptor will be referred to as indirect contact pathways. Where available, site-specific data will be used to determine exposure point concentrations for indirect contact pathways. Where site-specific data are unavailable and for future exposures, the exposure point concentrations for the secondary media may be determined using site-specific data where available. Mathematical models that take into consideration chemical-specific and media-specific properties to estimate the chemical concentration in the secondary exposure media may be used to predict future or off-site exposures.

Migration to and through groundwater to an off-site receptor often is a primary pathway in defining baseline risks and in calculating site-specific remediation levels. An important aspect of quantifying this pathway is defining the hydrogeologic conceptual model. This model sets the stage for quantitative estimates of chemical migration. The outputs of the modeling effort are chemical-specific dilution attenuation factors (DAFs), which are subsequently used both in the risk assessment and to develop remediation levels for off-site exposure to groundwater. DAFs incorporate physical, chemical and biological characteristics of the subsurface into one predictor of chemical migration from the vadose zone to the saturated zone. The two primary considerations in developing the DAFs are:

- (1) dilution, or mixing, of the chemical in groundwater in various directions; and
- (2) attenuation, including chemical binding (absorption, adsorption, ion exchange, and chemical bonding) of the chemical to the subsurface soil particles, and biological degradation (applicable only for organic compounds).

#### 8.3.3 Toxicity Assessment

The toxicity criteria that will be used in the risk assessment will be obtained from the most current update of the U.S. EPA Integrated Risk Information System (IRIS) or, if the information is not available in IRIS, the U.S. EPA Health Effects and Assessment Summary Tables (HEAST). IRIS is an electronic database containing the most current descriptive and quantitative U.S. EPA regulatory information on chemical constituents. Chemical files maintained in IRIS contain information related to noncarcinogenic and carcinogenic health effects. HEAST is a published reference, updated quarterly by EPA. It contains toxicity information and values for chemicals from health and environmental effects documents and profiles. Other sources of toxicity information that may be used include, the National Center for Environmental Assessment (NCEA) Provisional Values, Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profiles or EPA Criteria Documents.

IRIS and HEAST provide toxicity data for the oral and inhalation pathways only. For the dermal route of exposure, toxicity factors will be based on adjustments of the oral values based on the guidance provided by the (U.S. EPA 1989a and EPA 1992a). Chemical-specific permeability coefficients (for dermal contact with aqueous media) and dermal absorption values (for dermal exposures from soils) will be taken from U.S. EPA when available, and from the literature if not.

#### 8.3.4 Risk Characterization

Risks will be characterized by integrating the toxicity and exposure assessments into quantitative expressions of risk. To characterize carcinogenic risks, probabilities that an individual will develop cancer over a lifetime of exposure are estimated from projected intakes and chemical-specific dose-response information. To characterize potential noncarcinogenic effects, comparisons are made between the projected intakes of substances and approved toxicity values. Risks will be quantified for each exposure pathway for those COPCs for which EPA approved toxicological criteria exist according to the guidance (EPA 1989a).



| Area of Concern                                                                    | Receptor                                                                                                         | Environmental Media       | Pathway                                                                              | Assumptions                                                                                                                                                                                  |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Onsite                                                                             | Adult Worker                                                                                                     | Soil                      | Incidental Ingestion<br>Dermal Contact<br>Inhalation                                 | Workers may come in contact with contaminated media<br>while on-site via direct (dermal contact, incidental<br>ingestion) or indirect (inhalation of fugitive dust or radon)<br>contact      |
|                                                                                    |                                                                                                                  | Sediment<br>Surface Water | Dermal Contact                                                                       | Workers may contact contaminants in sediment and surface water while on-site                                                                                                                 |
|                                                                                    |                                                                                                                  | Groundwater               | Incidental Ingestion<br>Dermal Contact<br>Inhalation of Volatiles                    | On-site groundwater is currently used for potable use                                                                                                                                        |
| Onsite                                                                             | Adult and Child<br>Recreational Visitors                                                                         | Soil                      | Incidental Ingestion<br>Dermal Contact<br>Inhalation                                 | Recreational visitors may come in contact with<br>contaminated media while on-site via direct (dermal<br>contact, incidental ingestion) or indirect (inhalation of<br>fugitive dust) contact |
|                                                                                    |                                                                                                                  | Sediment<br>Surface Water | Dermal Contact                                                                       | Recreational visitors may contact contaminants in sediment and surface water while on-site using park facilities                                                                             |
| Offsite Nearby resid<br>(Adults and<br>Recreational<br>(Adults and<br>using Crosse | Nearby residents<br>(Adults and Children)<br>Recreational Visitors<br>(Adults and Children<br>using Crosses Run) | Soil                      | Incidental Ingestion<br>Dermal Contact<br>Inhalation                                 | If contaminated soils are discovered off-site, nearby<br>residents have the potential to contact this medium via<br>direct or indirect contact                                               |
|                                                                                    |                                                                                                                  | Sediment<br>Surface Water | Incidental Ingestion<br>Dermal Contact                                               | If contaminated surface water or sediments are discovered<br>off-site, nearby residents have the potential to contact this<br>medium                                                         |
|                                                                                    |                                                                                                                  | Groundwater               | Incidental Ingestion<br>Dermal Contact<br>Inhalation of Volatiles<br>(household use) | If groundwater is found to be contaminated and if it has<br>migrated or has the potential to migrate to off-site potable<br>wells, residents may be exposed via the groundwater<br>pathway   |

### Table 8.1. Scotts Company Facility Exposure Assumptions

#### 8.3.4.1 Quantification of Carcinogenic Risks

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen (i.e., incremental or excess individual lifetime cancer risk). Carcinogenic risks are calculated using the chronic daily intake determined through the exposure assessment and chemical specific toxicity criteria. The toxicity criterion used in the risk calculation is the slope factor (SF). The cancer risk equation is defined below:

Cancer Risk = CDI x SF

Where:

CDI = Chronic Daily Intake averaged over 70 years (mg/kg-day); and,

 $SF = chemical specific slope factor (mg/kg-day)^{-1}$ 

U.S. EPA guidance requires that risks associated with simultaneous exposures to several substances be estimated. In order to assess the risks posed by multiple chemicals, individual cancer risks are summed for each exposure pathway using the following equation:

 $Risk_1 = Risk_1 + Risk_2 + .... Risk_i$ 

Where:

Risk<sub>t</sub> = the total cancer risk, expressed as a unitless probability; and

 $Risk_i$  = the risk estimate for the i<sup>th</sup> substance,

The risk summation methodology assumes that there are no synergistic or antagonistic chemical interactions and that all substances result in the same carcinogenic effect.

#### 8.3.4.2 Quantification of Noncarcinogenic Risk

For noncarcinogens the potential for toxic effects is measured by comparing an exposure level over a specific time period with a chemical-specific reference dose derived for a similar exposure period. This ratio of exposure is called a hazard quotient. The noncancer hazard quotient assumes that there is a level of exposure below which it is unlikely that adverse health effects will occur, even to sensitive sub-populations. The threshold level is determined through animal and human epidemiological studies and is called the reference dose or RfD. The equation for determining the hazard quotient (HQ) is described below:

Noncancer Hazard Quotient = E/RfD

Where: E = exposure level (or intake); RfD = chemical-specific reference dose

If the hazard quotient exceeds unity (1), there may be a potential noncancer effect. To assess the overall potential for noncarcinogenic effects posed by more than one chemical, a hazard index (HI) approach is used. This approach assumes that simultaneous subthreshold exposures to several chemicals could result in an adverse health effect.

The HI is equal to the sum of the HQs, as shown below:

Noncancer Hazard Index =  $E_1/RfD_1 + E_2/RfD_2 + ... E_i/RfD_i$ 

Where:

 $E_i$  = exposure level (or intake) for the i<sup>th</sup> toxicant;

 $RfD_i$  = chemical-specific reference dose for the i<sup>th</sup> toxicant

The HI assumes that the magnitude of the effect will be proportional to the sum of the hazard quotients.

#### 8.3.5 Uncertainty Assessment

The uncertainty assessment will be a qualitative evaluation of the uncertainties associated with the exposure assessment, the toxicity information used in the risk assessment and the risk characterization. If results of the baseline risk assessment and a sensitivity analysis indicate that risk management decisions could potentially benefit from a quantitative analysis of uncertainty, a probabilistic analysis will be considered. Prior to conducting the analysis, the Scotts Company or their designee would prepare a work plan for review by the appropriate regulatory agencies.

#### 8.4 ECOLOGICAL RISK ASSESSMENT

Ecological risk assessments (ERAs) identify and evaluate the current and future risk to biota exposed to chemical contaminants and physical and biological hazards under existing (baseline) conditions. Risk is the likelihood of experiencing adverse effects. The ERA for the Scotts Company facility will focus on evaluating the potential of harmful effects on plants and animals as a result of exposure to chemical contaminants. Regulatory guidance for ecological risk assessments (ERAs) is contained in EPA's Guidelines for Ecological Risk Assessment (EPA 1998), Risk Assessment Guidance for Superfund, Vol. II, Environmental Evaluation Manual, Interim Final (EPA 1989b) and Ecological Risk Assessment for Superfund, Process for Designing and Conducting Ecological Risk Assessments (EPA 1994A).

A discussion of the scientific basis for assessing ecological effects is found in *Ecological Assessments of Hazardous Waste Sites: a Field and Laboratory Reference Document* (EPA 1989c) and *Procedural Guidelines for Ecological Risk Assessments at U.S. Army Sites* (Wentsel et al. 1994 and LaPoint et al. 1996). Other guidance is provided in EPA's ECO Update Intermittent Bulletins (1991b and 1996a) and EPA Region V Ecological Risk Assessment Bulletins (EPA 1996b). In addition, Ohio EPA guidelines for ERAs will be followed.

The specific ecological risk assessment (ERA) methodologies presented in this RFI work plan are designed to be a conservative screening evaluation based on available toxicity information. This screening ERA will identify which medium, which locations, which constituents, and which receptors likely show ecological risk. Should these results indicate the need for further investigation of some areas such as Crosses Run, the results of the screening ERA will focus these efforts. Biological investigations such as aquatic community surveys and toxicity tests have been reserved for this future investigation, if the screening ERA indicates they are necessary. This type of phased approach for Crosses Run is presented in Section 8.4.8.

The screening ERA follows U.S. EPA guidance for evaluating risks from hazardous waste sites, but should not be construed as a process that ignores Ohio's water quality standards. These water quality standards contain both chemical and biological endpoints. Chemical endpoints from Ohio's water quality standards will be included directly in the screening ERA. Biological endpoints will be considered in the screening ERA based on Ohio EPA's past evaluations of Crosses Run (Ohio EPA 1997). The need for additional evaluation of chemical and/or biological endpoints will be determined using the results of the screening ERA. The ultimate goal of this process is to identify impacts from The Scotts Company that pose unacceptable risks to ecological receptors or inhibit crosses run from achieving the appropriate aquatic life use. The screening ERA will focus primarily on chemical risks and chemical endpoints as these are the subject of the RCRA corrective action process. Future investigations would place more emphasis on biological endpoints that may be impacted by chemical (e.g., contamination) and/or physical (poor habitat) stressors. The relative impact of these stressors will be considered so that the most appropriate corrective action can be taken. The terminology used in the RFI work plan for these future investigations is a "baseline ERA."

The ERAs for the Scotts Company facility will be structured according to a general framework for ERAs (EPA 1992b). According to this framework, ERAs comprise four interrelated activities: ecological hazard identification or "problem formulation", followed by exposure and effects assessments, which are synthesized in the risk characterization. These activities are described below.

#### 8.4.1 Scope and Objectives of the Ecological Risk Assessment

The scope of ERA is to characterize the risk to plant and animal populations and habitats. It will assess the risk to ecological (rather than human) receptors, including animals in both terrestrial and aquatic environments. The ERA will focus on populations or groups of interbreeding individuals of a species, unless the species requires special protection, such as threatened and endangered (T&E) species protected under the Endangered Species Act (DOI 1973).

The ERA will be conducted in a manner consistent with U.S. EPA's ERA paradigm. ERAs identify and evaluate the current and future risk to biota exposed to chemical contaminants and physical or biological hazards under current (baseline) conditions. The assessment will begin with a screening ERA of both aquatic and terrestrial habitats that will include the identification of stressors, ecological receptors and ecological assessment and measurement endpoints. Risk is the likelihood of receptors experiencing adverse effects. Risk will be assessed using literature-based toxicity values. Contaminants that may pose unacceptable risks to ecological receptors will be identified.

The ERA for the Scotts facility will be structured according to a general framework for ERAs (EPA 1992). According to this framework, ERAs comprise four interrelated activities: ecological hazard identification or "problem formulation", followed by exposure and effects assessments, which are synthesized in the risk characterization.

The ERA will focus on risk to ecological receptors in and near Crosses Run. In addition, Landfills 1 through 5, Broadcast Areas 1 and 2, and Former Ponds No. 2, 3, 6, 7, and 8 also will be evaluated. Ecological risks can and do come from large units of landscape, e.g., many hundreds of hectares in size. Accordingly, the screening ERA will accommodate receptors with large home ranges (wide-ranging) as well as those receptors with small home ranges. Each of the various ecological risk assessment receptors will be evaluated in relationship to the sizes and locations of various exposure units (EUs) at The Scotts Company property. For example, receptors that are non-mobile (vegetation) or have very small home ranges (soil invertebrates, meadow voles, short-tailed shrews, and robins) could receive their entire exposure to constituents at a single

EU. Thus, the appropriate scale of the screening ERA for those receptors is EU by EU. In contrast, receptors with much larger home ranges (wide-ranging) receive exposure to constituents from multiple and adjacent EUs. Thus, for the wide-ranging receptors, the appropriate scale for the screening ERA will be groupings of EUs that are within an areal size that could fall within the receptor's home range size. Thus, both EUs or small site and multiple EUs, or site-wide scale considerations will be made part of the planning and intended implementation.

It is anticipated that when an RFI is conducted for any other investigative units (IUs) in the future, the BRA would be conducted according to the general procedures established in the RFI work plan and the Technical Memorandum. The EUs and receptors for any other IUs would depend on the locations, characteristics, and other factors that would affect exposure. EUs may be equivalent to individual IU areas or may include several IUs including IUs addressed in this RFI (EU groupings), if appropriate (i.e., if no action has been taken or residual contamination is present). The intent will be that the EU designations will encompass any contaminated areas likely to be encountered by the selected receptor. If wide-ranging receptors are appropriate, then multiple IUs would be combined for the EU. ERAs for future IUs would address all detected constituents through background comparisons, screening ecological risk assessments, and baseline ecological risk assessments (ERA), where necessary, to determine if corrective action is warranted.

The objective of the ERA is to assess the risk of harmful effects on ecological receptors from exposure to chemical contamination. These contaminants are called ecological contaminants of potential concern (ecological COPCs). When it has been demonstrated that ecological COPCs cause risk, they are called ecological contaminants of concern (ecological COCs). The exposure units to be evaluated in the ERA will include both terrestrial and especially aquatic habitats present at or near the Scotts Company facility. Media of concern will include surface soil, sediment, and surface water which may be contacted directly by ecological receptors or may result in the accumulation of contaminants in plants and animals which can cause animals ingesting those biota to be exposed. Surface soil should be defined based on the depth of biological activity and history of processes resulting in contamination of the site. Surface soils are expected to be defined as 0-0.6 meters (0-2 feet) in depth. Some soil-dwelling invertebrates (e.g., earthworms) do spend some of their life below two feet; however, the majority of their foraging habitat is in the upper few inches of soil within the 0 -2 ft. depth interval. For these receptors, the ERA will quantitatively evaluate exposure to surface soils from 0-2 ft. and address exposures to the 2-3 ft. depth interval qualitatively in the uncertainty section. Sediment is expected to be 0-0.3 m (0-0.5 feet) in depth. The depth range for sediment evaluation (0 - 0.3 meters)corresponds to the depth range of sediment inhabitation by sediment-dwelling fauna. Further, most sedimentdwelling organisms are found in the top few inches. Note that sediment greater than 0.3 meters in depth will be characterized for nature and extent of contamination. However, sediment at depths greater than 0.3 meters will not be evaluated in the ERA because these sediments are generally not inhabited, so there is little opportunity for exposure. Surface water is the third important medium. Groundwater is generally not evaluated for ecological risk unless it is likely to emerge downgradient as surface water in ponds, streams, or seeps, and direct evaluation of surface water is not feasible. If it is determined that this situation is present at the Scotts Company facility, then groundwater will be evaluated in the ERA. Surface water toxicity values will be used for groundwater.

A screening level ERA will be performed, using readily available toxicity screening data for an exceedance/no exceedance answer. Any exceedances will be further analyzed in another step in the screening ERA, using hazard quotients for a gradient answer. Work will proceed to other types of ERAs, e.g., baseline, if there is a demonstrated need based on the findings of the screening ERA.

#### 8.4.2 Problem Formulation

The problem formulation establishes the scope and focus of the assessment according to the overall objectives

of the investigation. The conceptual site model will be presented, including a habitat description, likely ecological receptors, including T&E species, and the pathways by which receptors are likely exposed to site contaminants. The problem formulation section defines the site-specific assumptions of the ERA in concordance with the conceptual site model and the scope. Assessment endpoints will be chosen for selected receptor populations, termed 'endpoint receptors.' The result of problem formulation will be a clearly defined analysis plan and scope for the ERA.

#### 8.4.2.1 Identification of Ecological Contaminants of Concern

Ecological COPCs will be identified in the preliminary screening assessment by comparing concentrations and physical-chemical properties of detected site contaminants to site-background concentrations and conservative toxicity screening thresholds. Site background will be established according to the methods presented in section 8.2.2. Region V ecological data quality levels (EDQLs) will be the primary source of conservative screening values. Where necessary, additional screening levels will be used upon approval of Ohio EPA. Only COPCs will be evaluated further in the risk assessment.

#### 8.4.2.2 Conceptual Site Model

The conceptual site model is a description of those attributes of the site that are known or assumed to influence what receptors may be exposed to site contaminants and how those receptors are potentially exposed (ASTM 1995). The species most likely to be exposed to site contaminants are those that reside or forage at the site, which is determined by the nature of the habitats at the site and the life histories and behaviors of species. Pathways by which receptors are potentially exposed to site contaminants are also described. Pathways will identify the source media, release mechanisms, exposure media, and exposure routes. Quantitative emphasis will be given to ingestion (food, water, and abiotic media) and direct contact (especially water) exposure routes. Dermal and airborne routes are expected to be minor and to be treated qualitatively if there were dermal or volatilization issues, the toxicity data for dermal and inhalation exposures are very limited for ecological receptors and few if any conclusions could be reached about risk. The preliminary conceptual site model will be presented in the Technical Memorandum and finalized in the ERA based on the findings of an ecological site survey.

#### 8.4.2.3 Habitat Description

A description of the ecological resources including plants, animals, threatened and endangered species, and sensitive habitats at the Scotts Company facility will be prepared following a site survey for these resources. To facilitate the development of a conceptual site model, the ecological site survey information will be used to prepare a simple habitat map. The map will include Crosses Run. In addition, a brief characterization of plant and animal resources in Crosses Run and undeveloped areas on the Scotts Company property will be conducted to further develop the conceptual model and identify ecological receptors potentially at risk.

#### 8.4.2.3 Identification of Ecological Receptors

After characterization of the ecological resources, receptors species will be specified in the conceptual model. The ecological receptors for the ERA will be selected from plant and animal species found in terrestrial and aquatic habitats at and near the Scotts Company facility. It is expected that the following types of receptors, either directly or indirectly, will be used:

For soil

• vegetation (variety of grasses, forbs, and trees)

- soil-dwelling invertebrates (earthworms)
- herbivores (meadow vole and deer)
- mid-level predators (short-tailed shrew and American robin)
- terrestrial top predators (red fox, transient red-tailed hawk and possibly threatened and endangered species)

#### For sediment

• sediment dwellers, e.g., molluscs, invertebrates (dragonfly nymphs and others)

#### For water

- aquatic biota, such as fish
- mink and belted kingfisher.

The screening ERA will accommodate receptors with large home ranges (wide-ranging) as well as those receptors with small home ranges. Each of the various ecological risk assessment receptors will be evaluated in relationship to the sizes and locations of various EUs at The Scotts Company property. For example, receptors that are non-mobile (vegetation) or have very small home ranges (soil invertebrates, meadow voles, short-tailed shrews, and robins) could receive their entire exposure to constituents at a single EU. Thus, the appropriate scale of the screening ERA for those receptors is EU by EU. In contrast, receptors with much larger home ranges (wide-ranging), such as red foxes (home range = 596 ha), red-tailed hawks (697 ha), whitetailed deer (175 ha), mink (2.4 km length of stream), and belted kingfisher (1.03 km length of stream), receive exposure to constituents from multiple and adjacent EUs. Thus, for the wide-ranging receptors, the appropriate scale for the screening ERA will be groupings of EUs that are within an areal size that could fall within the receptor's home range size. For example, a possible EU grouping for the deer and wide-ranging terrestrial predators would include Landfill 2, Landfills 4 and 5, and Field Broadcast Area 1. A second grouping for these receptors could include Former Ponds 2, 3, and 6 and Field Broadcast Area 2. For fish-eating predators such as mink, the groupings could be any two of the three segments of Crosses Run, such as the north and south branches of Crosses Run, or Crosses Run itself. Thus, both EUs or small site and multiple EUs, or sitewide scale considerations will be made part of the planning and intended implementation. The sediment- and water-dwelling ecological receptors will be used to characterize risk from any contamination in Crosses Run.

#### 8.4.2.5 Ecological Assessment and Measurement Endpoints

Protection of the environment and ecological resources, such as the species of plants and animals and habitats, is mandated by a variety of legislation and government agency policies [e.g., RCRA, CERCLA, NEPA]. Statements of key aspects of ecological protection are presented as policy goals (goals established by legislation or agency policy). A potential ecological assessment endpoint, measurement endpoint, and decision rule are provided in Table 8.2. These endpoints will be refined in the Technical Memorandum.

These assessment endpoints and measurement endpoints will be developed and evaluated per the decision rule in the ERA report.

#### 8.4.2.6 Analysis Plan

The analysis plan is the final stage of problem formulation. The plan includes three categories of measures to evaluate risk in the conceptual site model: measures of exposure (also termed measurement endpoints), measures of effect, and measures of receptor characteristics. The plan consolidates what and how exposure and effects information will be used in the following activities of exposure and effects assessment and risk characterization.

#### 8.4.3 Exposure Assessment

Exposure assessment estimates the extent and magnitude or distribution of exposure of biota to contaminants at the site (EPA 1991b). The exposure assessment will evaluate potential exposure pathways and identify the major quantifiable pathways, i.e., those that are expected to result in exposures to endpoint receptors that are large relative to other pathways and that can be quantified. For the major pathways, the ecological COPC concentrations to which receptors are exposed will be estimated from site measurements.

#### 8.4.3.1 Identification of Exposure Pathways

Possible pathways of exposure to ecological COPCs in source media at the Scotts Company facility will be briefly diagrammed, evaluated, and discussed. Complete exposure pathways will be distinguished from incomplete pathways. Complete pathways will be evaluated in the ERA as distinguished from incomplete pathways that will not be evaluated because they are thought to result in inconsequential exposure at the sites or cannot be quantified. As stated earlier, complete pathways are expected to be ingestion of various food and material and direct contact. By contrast, dermal and inhalation pathways are not expected to be complete pathways or associated with unacceptable risk as discussed in Section 8.4.2.2.

The assessment endpoints for the ERA will be quantitatively evaluated for the major complete pathways resulting in exposure of endpoint receptors.

#### 8.4.3.2 Site-Specific Biological Measurements

Measurement of contaminant concentrations in tissues of aquatic animals (body burdens) in the Mill Creek watershed including Crosses Run have been collected by Ohio EPA (Ohio EPA 1997). In addition, biological indices have been computed for aquatic communities. This information will be used to support the quantitative components of the screening ERA. If additional biological measurements (e.g., sediment toxicity) are determined to be necessary, the procedures for conducting these measurements will be issued later in another work plan. A description of these potential biological measurements is contained in-Section 8.4.8.2. Existing NPDES data also will be useful in the screening ERA.

#### 8.4.3.3 Quantification of Exposure

The exposure of an endpoint receptor to an ecological COPC in surface soil, sediment, surface water, or biota will be quantified. For some receptors, exposure may be quantified by multiplying an estimate of the ecological COPC concentration in the media by factors representing the dilution and/or magnification of contaminant concentrations that potentially occur in nature along the pathways from soil to the exposed organism. For example, if a receptor obtains one-half (50 percent) of its food from an area where the soil is contaminated with one unit of a substance, the receptor's food bioaccumulates the contaminant four times over the soil concentration, and the receptor absorbs 100 percent of the contaminant to estimate the exposure for that receptor. Exposure factors will be based on published information about diets and foraging areas of receptors and bioavailability and bioaccumulation potential of ecological COPCs (e.g., EPA 1993b). Bioaccumulation factors will be an integral part of each exposure; they will be used for soil to plant as well as plant to animal transfers.

The exposures of endpoint receptors to ecological COPCs in surface soil, surface water, sediment or biota will be estimated by multiplying exposure factors by the central tendency of the distribution of contaminant concentrations in the media. The particular concentration of ecological COPCs to which endpoint receptors

are directly or indirectly exposed will be estimated by the RME concentration. The RME concentration is the lower of the maximum detected concentration and the 95 % confidence limit on the mean (UCL). The RME is a conservative estimate of the central tendency of the distribution of contaminant concentrations in the samples, especially in those cases where the maximum detected concentration is the RME. Individual organisms are potentially exposed to the maximum concentrations at a site, which may be the maximum detected concentration. However, only T&E species at the Scotts Company facility would warrant characterizing risk to individuals exposed to concentrations at particular sample locations, as opposed to an average or expected concentration.

#### 8.4.4 Effects Assessment

An effect defines the type of likely adverse effects on receptors associated with contaminants (EPA 1991b). The effects assessment will rely on published information linking known exposure concentrations of contaminants and potentially effects observed in controlled toxicity tests for organisms similar to Scotts Company facility receptors. Effects assessment sections of the ERA will describe the appropriate effects-threshold concentrations derived from published information.

#### 8.4.4.1 Toxicity

Chronic toxicity of COPCs is likely the primary concern at the Scotts Company facility exposure units. During the site habitat survey, visual inspection of vegetation (absence, stunted, necrotic) and animals (absence, apparent sickness) will be observed to confirm this impression. Attention will be given any field-observed effects in Crosses Run. Attention will be given to stream biota.

#### 8.4.4.2 Identification of Effects Thresholds

Effects thresholds will be based on data obtained from published studies on test organisms that have been compiled and used to estimate toxicological benchmarks or dietary limits for wildlife species.

For the screening ERA, screening values will be obtained from EPA Region V EDQLs. In the absence of EDQLs for particular COPCs, screening values will be selected from Ohio EPA-approved sources. EDQLS will be used for surface soil, sediment and surface water constituents. Specific EDQL values and sources will be provided in the Technical Memorandum.

For the more rigorous hazard quotient work, toxicity benchmarks for soil for endpoint receptors will be those reported in sources such as BTAG values, Opresko et al. (1995), and Sample et al. (1996) or calculated from data published in electronic databases (IRIS, RTECS, HSDB) using the methods described in Opresko et al. (1995) or their equivalent. It is assumed that there will be no indirect effects on populations and no ecosystem-level effects if endpoint receptor populations are exposed to concentrations of ecological COPCs less than the toxicity benchmark levels associated with the no observed adverse effect level (NOAEL) for non T&E species and factors, e.g. 0.1 or 0.01, of the NOAEL for individuals belonging to T&E species.

### Table 8.2. Policy Goals, Ecological Assessment Endpoints, Measurement Endpoints, and Decision Rules for Scotts Company facility

| Policy Goals                                                                                              | Assessment Endpoint                                                                                                                                                                                                                        | Measurement Endpoint                                                                                                                             | Decision Rule                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Policy Goal 1:</b> The preservation<br>and conservation of T&E species<br>and their critical habitats. | Assessment Endpoint 1: Preservation of any state- or<br>federally-designated threatened or endangered<br>species.<br>Endpoint Species: to be determined                                                                                    | Measurement Endpoint 1: Modeled<br>contaminant concentrations in prey<br>(shrews, robins, and rabbits) based on<br>measured soil concentrations. | <b>Decision Rule for Assessment Endpoint</b><br>1: If T&E species are not present, or RME<br>concentrations in the media do not<br>contribute to chronic NOAEL exceedance<br>(i.e., 1IQs <1), then it is indicated that the<br>contaminant alone is unlikely to cause<br>adverse ecological effects, and, therefore,<br>the T&E species are preserved. If the HQ<br>>1, a weight-of-evidence evaluation will be<br>conducted to determine the potential for<br>ecological risk and the need for any<br>additional measurements or calculations. |
| <b>Policy Goal 2:</b> The maintenance<br>and protection of terrestrial<br>populations and ecosystems.     | Assessment Endpoint 2:<br>Maintenance of plant community for erosion control<br>and energy production.<br>Endpoint Species: plants of various species                                                                                      | Measurement Endpoint 2: Measured soil contaminant concentrations.                                                                                | Decision Rule for Assessment Endpoint<br>2:<br>If the IIQ is <1, then it is indicated that the<br>contaminant alone is unlikely to cause<br>adverse ecological effects and, therefore,<br>the plant populations and communities are<br>maintained. If the HQ >1, a weight-of-<br>evidence evaluation will be conducted to<br>determine the potential for ecological risk<br>and the need for any additional<br>measurements or calculations.                                                                                                    |
|                                                                                                           | Assessment         Endpoint         3:         Maintenance         of           soil-dwelling invertebrate community for nutrient and energy processing.         Endpoint Species: earthworms         Endpoint Species:         Earthworms | Measurement Endpoint 3: Measured<br>soil contaminant concentrations                                                                              | <b>Decision Rule for Assessment Endpoint</b><br>3: If the HQ is <1, then it is indicated that<br>the contaminant alone is unlikely to cause<br>adverse ecological effects and, therefore,<br>the soil invertebrate community is<br>maintained. If the HQ >1, a<br>weight-of-evidence evaluation will be<br>conducted to determine the potential for<br>ecological risk and the need for any<br>additional measurements or calculations.                                                                                                         |

| Table 8.2. Policy Goals, Ecological Assessment Endpoints, Measurement Endpoints, and Decision Rules for Scotts Company facility |                                                                                                                                      |                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
|---------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|                                                                                                                                 | Contii                                                                                                                               | nued                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
| Policy Goals                                                                                                                    | Assessment Endpoint                                                                                                                  | Measurement Endpoint                                                                                                                                                | Decision Rule                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Policy Goal 2<br>(Continued)                                                                                                    | Assessment Endpoint 4:<br>Maintenance of populations of herbivorous animals.<br>Endpoint Species: meadow voles and deer              | <b>Measurement Endpoint 4:</b> Modeled<br>contaminant concentrations in food chain<br>based on measured soil contaminant<br>concentrations.                         | <b>Decision Rule for Assessment Endpoint</b><br>4: If the HQ is <1, then it is indicated that<br>the contaminant alone is unlikely to cause<br>adverse ecological effects and, therefore,<br>populations of the herbivores, e.g.,<br>cottontail rabbits and deer (possibly) are<br>maintained. If the HQ >1, a<br>weight-of-evidence evaluation will be<br>conducted to determine the potential for<br>ecological risk and the need for any                                                              |  |
|                                                                                                                                 | Assessment Endpoint 5: Maintenance of<br>worm-eating and/or insectivorous animals.<br>Endpoint Species: mammal – shrew; bird – robin | Measurement Endpoint 5: Modeled<br>contaminant concentrations in<br>earthworms and other prey based on<br>measured soil contaminant<br>concentrations.              | additional measurements or calculations.<br>Decision Rule for Assessment Endpoint<br>5: If the HQ is <1, then it is indicated that<br>the contaminant alone is unlikely to cause<br>adverse ecological effects and, therefore,<br>populations of worm-eating and/or<br>insectivorous animals are maintained. If<br>the HQ >1, a weight-of-evidence<br>evaluation will be conducted to determine<br>the potential for ecological risk and the<br>need for any additional measurements or<br>calculations. |  |
|                                                                                                                                 | Assessment Endpoint 6: Maintenance of terrestrial<br>predators.<br>Endpoint Species: mammal - red-fox; bird – red-tailed<br>hawk     | Measurement for Endpoint 6: Modeled<br>contaminant concentrations in prey<br>(shrews, robins, and rabbits) based on<br>measured soil contaminant<br>concentrations. | Decision Rule for Assessment Endpoint<br>6: If the HQ is <1, then it is indicated that<br>the contaminant alone is unlikely to cause<br>adverse ecological effects, and therefore,<br>populations of terrestrial predators are<br>maintained. If the IIQ >1, a<br>weight-of-evidence evaluation will be<br>conducted to determine the potential for<br>ecological risk and the need for any<br>additional measurements or calculations.                                                                  |  |

| 1 able 8.2. Folicy Goals                                                                           | , Ecological Assessment Enupoints, Measur<br>Conti                                                                                                    | nued                                                                                                                                      | ies for Scotts Company facility                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Policy Goals                                                                                       | Assessment Endpoint                                                                                                                                   | Measurement Endpoint                                                                                                                      | Decision Rule                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Policy Goal 3</b> : The maintenance<br>and protection of aquatic<br>populations and ecosystems. | Assessment Endpoint 7:<br>Maintenance of aquatic organisms.<br>Endpoint Species: aquatic organisms                                                    | <b>Measurement Endpoint 7:</b> Measured surface water contaminant concentrations.                                                         | <b>Decision Rule for Assessment Endpoin</b><br>7: If the IIQ is <1, then it is indicated tha<br>the contaminant alone is unlikely to caus<br>adverse ecological effects, and therefore<br>populations of aquatic organisms ar<br>maintained. If the IIQ >1,<br>weight-of-evidence evaluation will b<br>conducted to determine the potential fo<br>ecological risk and the need for an<br>additional measurements or calculations.            |
|                                                                                                    | Assessment Endpoint 8:<br>Maintenance of sediment-dwelling organisms.<br>Endpoint Species: sediment-dwelling organisms                                | <b>Measurement Endpoint 8:</b> Measured sediment contaminant concentrations.                                                              | <b>Decision Rule for Assessment Endpoin</b><br>8: If the HQ is <1, then it is indicated that<br>the contaminant alone is unlikely to caus<br>adverse ecological effects, and therefore<br>populations of sediment-dwellin<br>organisms are maintained. If the HQ >1,<br>weight-of-evidence evaluation will be<br>conducted to determine the potential for<br>ecological risk and the need for an<br>additional measurements or calculations. |
|                                                                                                    | Assessment Endpoint 9:<br>Maintenance of fish-eating predator population for<br>population regulation<br>Endpoint Species: mink and belted kingfisher | <b>Measurement Endpoint 9:</b> Modeled<br>contaminant concentrations in prey (fish)<br>based on measured surface water<br>concentrations. | <b>Decision Rule for Assessment Endpoin</b><br>9: If the HQ is <1, then it is indicated that<br>the contaminant alone is unlikely to caus<br>adverse ecological effects, and therefore<br>populations of terrestrial predators ar<br>maintained. If the HQ >1,<br>weight-of-evidence evaluation will b<br>conducted to determine the potential for<br>ecological risk and the need for an<br>additional measurements or calculations.        |

Threatened and endangered No observed adverse effects level Hazard (risk) quotient T&E =

NOAEL = HQ =

In the absence of NOAELs, lowest observed adverse effects levels (LOAELs) will be converted to NOAELs using a factor of 10. Benchmarks for birds and mammals (when different from the site receptors) will not be adjusted for body weight. Any differences will be discussed in the uncertainty section. Benchmarks for aquatic-dwelling and sediment-dwelling organisms are the same in the baseline ERA as for the screening ERA.

#### 8.4.5 Risk Characterization

Risk characterization integrates the findings of the exposure and effects assessments to estimate the likelihood that receptors experience adverse effects as a result of exposure to ecological COPCs (EPA 1991b). The risk to ecological receptors at the Scotts Company facility will be characterized by calculating hazard quotients (HQs). An HQ compares the estimated exposure concentration of an ecological COPC and the toxicity threshold concentration associated with a specified level of effect on receptor organisms exposed to the COPC.

#### 8.4.5.1 Calculation of Risk Quotients

For the Scotts Company facility, HQs will be calculated for endpoint receptors. The exposure of endpoint receptors to ecological COPCs in soil, surface water, sediment or biota will be estimated as the product of the measured environmental concentration and the exposure factors estimating the fraction of the diet that is ingested from the sites, bioaccumulation, as well as the fraction of what is ingested that is absorbed (assumed to be 100 percent). The estimated exposure concentration is divided by the effects-threshold concentration (i.e., benchmark dose or published dietary limit for the receptor and ecological COPC) to give the HQ. That is,

$$\frac{HQ = Cs \times SI \times AF + Cs \times Br \times FI_p + Cs \times BAF_{inv} \times FI_{inv} + Cs \times BAF_{sm} \times FI_{sm}}{Bw \times TRV} \times AUF \times TUF$$

where:

Cs = concentration of contaminant in soil (mg/kg)

SI = amount of soil ingested daily (g/day)

AF = fraction of contaminant absorbed from soil

Br = bioaccumulation factor for untaminate from soil to fruits and seeds (unitless)

 $FI_p$  = quantity of food ingested that is plant (g/day)

 $BAF_{inv}$  = bioaccumulation factor for earthworms and other soil invertebrates (unitless)

 $FI_{inv}$  = quantity ingested that is soil invertebrates (g/day)

BAF<sub>sm</sub> = bioaccumulation factor for small mammals (unitless)

 $FI_{sm}$  = quantity ingested that is small mammals (g/day)

AUF = area use factor (unitless)

TUF = temporal use factor (unitless)

BW = body weight (kg)

TRV = threshold limit value (mg/kg/BW/day)

For sediment and surface water exposure, the measured concentrations in each of these two media will be used as is and likely expressed as the 95 percent UCL of the mean. Then this statistic will be compared directly to the toxicity reference value.

#### 8.4.5.2 Summary of COPCs with HQs > 1

Because of uncertainties in quantifying exposure and effects, the exposure and effects assessments will be designed to produce HQs that minimize the probability of falsely concluding that there is no risk when in fact there is. Therefore, ecological COPCs with HQs that indicate little to no likelihood of risk to the endpoint receptors and with HQs less than 1.0 will not be discussed. To minimize the probability of falsely concluding there is risk when there is none, the risk characterization will be evaluated in greater depth the exposure estimates and effects thresholds for those ecological COPCs with HQs indicating potential risk.

The definition of an HI is the sum of all individual HQs for ecological COPCs that have similar toxicological effects (e.g., neural, immunolgical, excretory, or organ). In the screening ERA, a more conservative approach will be taken. All HQs, regardless of toxicological effect, will be summed to compute the HI. Therefore, if the HI does not exceed a threshold, the HI for a single toxicological effect also cannot exceed the same threshold. In screening ERAs, any HI greater than 1 means that ecological risk may be unacceptable and that a baseline ERA should follow. By contrast, an HI less than 1 means risks are acceptable. While there is no known EPA policy on HI magnitudes and corresponding nominal levels of risk, the decision threshold of an HI of 1 remains sufficient to define unacceptable ecological risk for a screening ERA suggesting that a baseline ERA should be conducted.

Therefore, for the screening ERA unacceptable risk will be defined as an HQ and/or an HI greater than 1.0. If an unacceptable risk is identified, a baseline ERA will be initiated. Futhermore, exceedance of Ohio's chemical water quality standards also will be an indicator to proceed with baseline ERA activities (see Section 8.4.8).

#### 8.4.6 Uncertainty Assessment

The uncertainties in the ERA will be discussed. Uncertainties in each of the four interrelated activities of the ecological risk assessment process will be addressed qualitatively, with an indication of whether the effect of method of treatment of the uncertainty results in an under or over estimate of risk as quantified by the HQs. Risk characterization may include the following distinctions: off-unit risk, cumulative risk, future risk, and background risk.

#### 8.4.7 RISK DESCRIPTION SECTION

Ecological COCs will be identified from those ecological COPCs with risk quotients sufficiently large to overcome known conservatism and uncertainties in the exposure and effects parameters. Based on the quantitative assessment of risk using HQs, HIs, and qualitative assessment of uncertainty, ecological COCs will be identified. The development of professional judgement criteria for weight of evidence will incorporate various types of information into such principles as:

- temporal association of the contamination and the receptors and their predicted response,
- spatial association of the contamination and the receptors and their predicted response,
- strength of dose response association of the exposure and the effects data, and
- biological plausibility of the risk being predicted at its hazard quotient levels.

Weight of evidence analysis will include such technical matters as the results of the Ohio EPA biological assessment of the Mill Creek watershed, evaluation and habitat survey, the quality and quantity of the exposure data, the quality and quantity of the effects information, the magnitude of the HQ (the higher the more likely the risk is real), and the applicability of any State or Federal standards such as Ohio's chemical water quality standards. The appropriateness of NOAEL- or LOAEL-based effects and ER-L- or ER-M-based effects will be part of this weight of evidence. Thus, ecological COCs are those contaminants for which the weight of evidence indicates remedial action is required to reduce risks to receptors to acceptable levels. Note that ecological COCs identified in the screening ERA may be further evaluated in a baseline necessary if available evidence indicates the need for this next step. This baseline ERA may include sediment toxicity tests for Crosses Run.

#### 8.4.8 BASELINE ERA FOR CROSSES RUN

If unacceptable risks to ecological receptors as defined in Section 8.4.5.2 or exceedances of Ohio's water quality standards are identified in the screening ERA, the baseline ERA will be implemented to better define the causative agents/sources and site-specific impacts in Crosses Run. Describing the causes and sources associated with observed impairments to a stream's biological integrity and linking this with pollution sources involves an interpretation of multiple lines of evidence including water chemistry data, sediment data, the quality of the habitat, and biological data. Sediment provides habitat for a variety of aquatic organisms and is a major repository for persistent chemicals that may have been inadvertently introduced into surface water. In the aquatic environment, many anthropogenic waste materials, especially hydrophobic materials, eventually accumulate in sediment.

Should the screening ERA indicate the need to perform a baseline ERA, a combination of numeric and descriptive measures will be used to better assess conditions in Crosses Run. The proposed approach, referred to by U.S. EPA as the sediment-quality triad, consists of an assessment of sediment chemical contamination, sediment toxicity, and benthic community structure (EPA 1996). Correspondence between sediment chemistry, sediment toxicity, and field effects will be used to determine sediment concentrations that may result in measurable biological effects. The major advantage of the sediment-quality triad approach is that the three measures can be used together or apart in a weight-of-evidence approach to differentiate between toxicity related to contamination from natural variability and/or laboratory artifacts.

The sediment-quality triad is consistent with the framework that will be used for the baseline ERA. The information obtained from implementation of the triad will provide site-specific physical, chemical, toxicological, and biological information that will replace the generalized information (i.e., literature-based) used in the screening ERA. Should the screening ERA indicate the need for further characterization of Crosses

Run, a "Baseline ERA Work Plan" that contains elements of the sediment-quality triad will be developed. The baseline ERA work plan will contain some or all of these elements depending on the recommendations of the risk assessment. Elements of the sediment-quality triad that will be considered in the baseline ERA work plan are discussed in the following sections. The results of the baseline ERA investigation will be presented in a baseline ERA report.

#### 8.4.8.1 PHYSICAL AND CHEMICAL ANALYSIS OF SEDIMENT

In order to make sediment management decisions, one must be able to link biological effects to the causative agent(s). In terms of chemically-based effects, the form, and concentration of individual substances or mixtures of compounds in sediment must be known. The uptake of sediment-associated constituents is largely a function of bioavailability. Bioavailability is strongly influenced by a complex suite of physical, chemical and biological factors in sediment. Therefore, knowledge of the sediment characteristics that control biological availability of sediment contaminants is a prerequisite for predictive assessment of sediment quality. Especially for polar organic chemicals, adsorption mechanisms may significantly decrease the amount of the constituent that would be biologically available.

In order to obtain a more complete understanding of the bioavailability of sediment contaminants, physicochemical characterization of crosses run sediment, including analysis of sediment organic carbon, sediment particle size, sediment pH, redox potential and acid volatile sulfide, will be conducted to assess contaminant partitioning between sediment and surface water. Since some of the constituents released into crosses run are low-solubility, neutral organic compounds that are expected to readily sorb to the organic matter associated with sediment, equilibrium partitioning coefficients (EQP) will be used to predict the magnitude of this sorption. The bulk sediment contaminant concentrations measured at the site will be adjusted using the EQP approach. Chemical analysis of sediment will also be conducted to characterize the spatial distribution of contaminant concentrations in Crosses Run and in sediment used for bioassays. Guidance on the chemical analysis of sediment that will be utilized for the assessment of Crosses Run will include:

Toxicological Benchmarks For Screening Contaminants Of Potential Concern For Effects On Sediment-Associated Biota: 1996 Revision, Jones, D.S., R.N. Hull, G.W. Suter II, U.S. Department Of Energy, June 1996

Contaminated Sediment Management Strategy, U.S. Environmental Protection Agency, Office Of Water, EPA-823-R-98-001.

#### 8.4.8.2 SEDIMENT BIOASSAYS USING FRESHWATER INVERTEBRATES

Sediment bioassys will be considered as one possible method for investigating any unacceptable risks identified in crosses run sediment. Protocols for both in-situ and ex-situ methods will be considered when determining whether to perform sediment bioassys. U.S. EPA has not published protocols for in-situ bioassays, but independent researchers have developed and tested in-situ procedures. The reliablibility of these methods will be one consideration when determining whether to implement sediment bioassays. U.S. EPA has published several protocols for performing ex-situ bioassays. These protocols and how they might be implemented at the Scotts facility are briefly discussed below.

In ex-situ sediment bioassays, test organisms are exposed to sediment that may contain potentially toxic chemicals. At the end of the test, response of the test organisms to sediment are examined as increases in mortality and decreases in growth relative to organisms exposed to control or reference sediment. Ex-situ sediment bioassays using freshwater invertebrates have been proposed as a possible tool for the derivation of site-specific sediment remediation goals. These tests are proposed to measure interactive toxic effects of the complex contaminant mixtures present in Crosses Run sediment. The following procedures describe test protocols to be used to evaluate the toxicity of sediment-associated contaminants found in Crosses Run near the Scotts facility.

#### **TEST ORGANISMS**

Standard test methods for ex-situ sediment bioassays have been outlined by U.S. EPA for two freshwater organisms, the amphipod, Hhyalella azteca, and the midge, Chironomus tentans (EPA 1994b). The availability of a database demonstrating relative sensitivity to contaminants, contact with sediment, ease of culture in the laboratory, inter-laboratory comparisons, tolerance to varying sediment physicochemical characteristics, and field validation were the primary criteria used to select these organisms (EPA 1994c). The use of any other organism would require significant additional research and the development of appropriate test methods.

Although general guidance is currently available for evaluating the bioaccumulation of contaminants in sediment using Lumbriculus variegatus, many critical issues necessary for the interpretation of test results are the subjects of continuing research. Given the lack of standardized test methods and uncertainty with respect to the interpretation of test results, bioaccumulation testing is not proposed at this time.

#### **SUMMARY OF METHOD**

The procedures used to conduct ex-situ sediment bioassays will be consistent with those outlined in EPA guidance:

# Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates (EPA 1994c).

Toxicity tests would be run for two organisms, the amphipod, *Hyallela azteca*, and the midge, *Chironomus tentans*. Although EPA has not issued standard procedures for culturing freshwater test organisms to be used in sediment bioassays, laboratory-raised, healthy test organisms of known quality and age would be used for the tests. Ex-situ sediment bioassays would be conducted for 10 days in 300-milliliter (ml) chambers containing 100 ml of sediment and 175 ml of overlying water. Overlying water will be renewed daily and test organisms will be fed during the toxicity tests. The endpoints for both *H. azteca* and *C. tentans* will be survival and growth. Eight replicates will be tested for each sediment sample.

Using existing RFI data as a guide, sediment samples will be collected to include the range of sediment contaminant concentrations found in crosses run. Sediment will be collected from seven test sites. Sediment samples will include the maximum and minimum concentrations detected and five intermediate concentrations. With seven incremental concentrations, the deflection point, or the no observed adverse effect level (NOAEL) will be determined. In addition, the concentration that is lethal to 50 percent of test organisms ( $LC_{50}$ ) will be determined.

#### CONTROL AND REFERENCE SEDIMENT

Ex-situ bioassays will be conducted on sediment samples from three reference sites and with laboratory control sediments. Reference locations will include the north and south branch of crosses run upgradient of the Scotts property, Big Darby Creek sediment and laboratory control sediment.

#### 8.4.8.3 BENTHIC COMMUNITY SURVEY

Sediment provides habitat for a variety of aquatic organisms and is a major repository for persistent chemicals that may have been inadvertently introduced into surface water. The analysis of benthic community structure is proposed as a potential component of the baseline ERA in order to evaluate the current status of Crosses Run as indicated by alterations in the diversity and abundance of benthic organisms. The Scotts Company intends to take actions that will eliminate potential sources of contamination from the IUs to Crosses Run. If the flow of water in Crosses Run is persistent, the benthic community survey will be used to monitor the response of sediment biota as potential sources are eliminated.

Ohio EPA incorporated biological criteria into the Ohio water quality standards in February 1990. These criteria consist of numeric criteria for the index of biotic integrity (IBI) and modified index of well-being (MIWB), both of which are based on fish assemblage data, and the invertebrate community index (ICI) which is based on macroinvertebrate assemblage data. Criteria for each index are specified for each of Ohio's five ecoregions. And are further organized by organism group, index, site type and aquatic life use designation.

A report on the watershed which includes crosses run titled "Biological and Water Quality Study of Mill Creek and Selected Tributaries", was completed by Ohio EPA in June 1997. This report included fish and invertebrate sampling and analysis conducted in 1995 in order to assess the condition of the biotic community in Crosses Run. The benthic community assessment proposed for the baseline ERA would constitute a follow-up biological monitoring survey to assess current conditions in Crosses Run. Field and laboratory methods that would be used for the benthic community survey can be found in the following Ohio EPA guidance documents:

Biological Criteria For The Protection Of Aquatic Life:

Volume I: The Role of Biological Data in Water Quality Assessment, Ohio EPA, Division of Surface Water, July 24, 1987 (Updated February 15, 1988)

Volume II: Users Manual for Biological Field Assessment of Ohio Surface Waters, Ohio EPA, Division Of Surface Water, October 30, 1987 (Updated January 1, 1988)

Volume III: Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities, Ohio EPA, Division Of Surface Water, September 30, 1989.

Available habitat is an important factor in determining the diversity and abundance of organisms. Therefore, in conjunction with the benthic community sampling, a qualitative habitat assessment and quantitative stream flow study will be conducted. The methods for assessing habitat quality will be consistent with the Ohio EPA guidance document,

The Qualitative Habitat Evaluation Index [QHEI]: Rationale, Methods, and Application, Ohio EPA, Division Of Surface Water, November 6, 1989.

The quantitative flow study will use past measurements of stream flow in Crosses Run and additional measurements taken during the benthic community sampling to assess seasonal flow conditions in Crosses Run. The results of this study and the QHEI measurements will provide a site-specific context for assessing impacts to stream biota from chemical contaminants.

#### 8.4.9 ERA REPORTING

The screening ERA will be presented in the RFI report. The technical memorandum will present the detailed methodology for performing the screening ERA. This methodology and the risk assessment results will form the basis of the screening ERA report. This report will contain the following elements:

- review of the conceptual model and the assessment endpoints.
- discussion of the major data sources and analytical procedures used.
- review of the toxicity information and exposure profiles.
- description of risks to the assessment endpoints, including risk estimates.
- review and summarization of major areas of uncertainty (as well as their direction) and the approaches used to address them.
- discussion of the degree of scientific consensus in key areas of uncertainty.
- identification of major data gaps and, where appropriate, indicate whether gathering additional data would add significantly to the overall confidence in the assessment results.
- discussion of science policy judgements or default assumptions used to bridge information gaps and the basis for these assumptions.

The content of the baseline ERA report will depend on the methods selected to further investigate any unacceptable risks identified in the screening ERA. The baseline ERA work plan will identify these methods and describe the reporting requirements of the baseline ERA report.

#### References:

American Society Of Testing And Materials (ASTM), 1995. ASTM E 1698-95, Standard Guide for Developing Conceptual Site Models for Contaminated Sites, approved March 15, 1995.

U.S Department Of Interior (DOI), 1973. Endangered Species Act of 1973. Amended in 1988. U.S. Department of Interior, Washington, D.C.

Environmental Protection Agency (EPA), 1989a. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A), EPA 540/1-89/002, December, 1989, PB90-155581.

EPA, 1989b. Risk Assessment Guidance for Superfund, Volume II: Environmental Evaluation Manual. EPA/540/1-89-001. U.S. Environmental Protection Agency.

EPA, 1989c. Ecological Assessments of Hazardous Waste Sites: a Field and Laboratory Reference Document. EPA/600/3-89/013.

EPA, 1989d. Exposure Factors Handbook.

EPA, 1991a. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part B and Part C), EPA 540/R-92/003 and EPA 540/R-92/004, December, 1991.

EPA, 1991b. "Ecological Assessment of Superfund Sites: An Overview" ECO Update 1(2),Office of Solid Waste and Emergency Response, Publ. 9345.0-05I.

EPA, 1992a. Dermal Exposure Assessment; Principles and Applications. EPA/600/8-91/011B, January, 1992.

EPA, 1992b. Framework for Ecological Risk Assessment. Risk Assessment Forum, U.S. Environmental Protection Agency, EPA/630/R-92/001.

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Section 9 PROJECT MGM. PLAN

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# **PROJECT MANAGEMENT PLAN**

# **SECTION 9**

# **RCRA FACILITY INVESTIGATION WORK PLAN**

## FOR

THE SCOTTS COMPANY 14111 Scottslawn Road Marysville, Ohio 43041

June 11, 1999

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### APPENDIX

Appendix 9A Key Personnel

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#### 9.0 PROJECT MANAGEMENT PLAN

#### 9.1 INTRODUCTION

The purpose of the project management plan is to describe the technical approach to the RFI and provide the qualifications and responsibilities of the individuals performing work under of the investigation.

The technical approach to this RFI is designed to provide a high-quality, technically-sound site investigation in the most cost-effective manner. The RFI will utilize historical environmental data and site information to the maximum extent possible. Field activities as described within this RFI Work Plan will be designated to complement the extensive historical data and thus minimize additional sampling.

The resulting data will be compiled and presented in a RFI Report, which is anticipated to be specific to each area of concern.

#### 9.2 **PROJECT ORGANIZATION**

The RFI project will be performed in accordance with the Scotts RFI Work Plan. Figure 9.1 depicts the key Scotts and SAIC personnel dedicated to the various RFI project activities. All personnel are highly qualified in their respective areas of responsibility, and individually possess between 8 and 20 years of relevant experience with multi-faceted environmental site investigations for both government and commercial clients. In the event that roles or responsibilities under this RFI change, appropriate revisions will be made to the Project Management Plan.

#### 9.2.1 Project Management

The RFI Project Manager is Mr. Rich Carter. Mr. Carter is a Senior Environmental Scientist who brings more than 13 years of regulatory expertise, including eight years of regulatory and management experience at Ohio EPA, and more than six years of project management experience with RCRA Corrective Action projects for government and commercial clients in Ohio.

Mr. Carter will be responsible for managing the entire RFI process at Scotts. Mr. Carter will prepare and submit monthly progress reports to Ohio EPA, detailing and updating progress on field activities, scheduling, and deliverables.

Mr. Carter's responsibilities will include management and oversight of all RFI activities and deliverables, and compliance with Ohio EPA and other applicable regulatory guidance and requirements. Mr. Carter will also be responsible for ensuring that the RFI work is performed in accordance with the Field Sampling Plan (Section 4), Quality Assurance Plan and Procedures (Section 5), Health and Safety Plan (Section 6), and the Data Management Plan (Section 7).

#### 9.2.2 Field Team

The Field Manager is Mr. Brad Richardson. Mr. Richardson is a Senior Project Geologist/Hydrogeologist with more than 14 years of experience in the environmental sciences, including planning, implementation and technical supervision of RCRA field investigations.
Mr. Richardson's responsibilities will include management and oversight of the field crew, field equipment, and of all field efforts for the RFI. Mr. Richardson will be responsible to ensure that the fieldwork is performed under compliance with the site-specific Quality Assurance Plan and Procedures (Section 5), Health and Safety Plan (Section 6), and the field-related aspects of the Data Management Plan (Section 7). Mr. Richardson will be responsible for providing direction and oversight for drilling subcontractors and other field subcontractors that may be employed on this project.

The fieldwork required to perform this RFI will include direct push technology sampling, installation of borings and monitoring wells, collecting soil, sediment, surface water and groundwater samples, managing the samples under the applicable QA and data documentation and tracking protocols, and implementation of the decontamination and well abandonment procedures.

#### 9.2.3 Data Management

The Data Manager is Mr. Dave Korns. Mr. Korns is the manager of the Information Management and Technology Section, and brings over 14 years of experience with environmental data management projects. Specifically, he specializes in environmental data quality, data analysis, geographical information systems, and information technology. He has written and implemented data management plans for numerous government and commercial clients.

Mr. Korns will be responsible for analysis of the raw data gathered during the field investigation and for presentation of the data in tabular and graphical form. Mr. Korns will manage the documentation and tracking of all data in accordance with the site-specific Data Management Plan (Section 7).

The data management effort will include sample designation and identification for soil, sediment, surface water, and groundwater. Additionally, document tracking will be required under this function, which will include detailed designation and record keeping for raw and validated data, photographs, site maps and surveys, chain of custody records, logbooks, laboratory records, and other project files. All information will be electronically filed and formatted for optimal tracking and usability.



Figure 9.1. RFI Project Management Organization for The Scotts Company, Marysville Ohio

#### 9.2.4 Quality Assurance/Quality Control

The Quality Assurance/Quality Control (QA/QC) Manager is Mr. Steve McBride. Mr. McBride has over 13 years of QA/QC experience in chemical sampling and analysis, including supervision of laboratory operations. He has provided extensive data validation support, and has written and implemented numerous Quality Assurance Project Plans.

Mr. McBride will be responsible to ensure that the investigation is performed under the appropriate QA/QC standards. Mr. McBride will manage the QA/QC aspects of the RFI in accordance with the Quality Assurance Plan and Procedures (Section 5).

The quality assurance effort will document all sampling, field measurement, sample analysis and sample validation procedures during the RFI to characterize the environmental setting, source and contamination. This will ensure that all information, data and resulting decisions are technically sound, statistically valid, and properly documented.

#### 9.2.5 Health and Safety

The Health and Safety Manager is Ms. Martha Clough. Ms. Clough has more than eight years of experience as an environmental safety specialist, and holds numerous safety certifications, including OSHA 40 HAZWOPER training and both Hazardous Materials Technician and Safety Officer Specialist for Emergency Response. Ms. Clough has extensive site investigation experience as well as experience in writing and implementation of health and safety programs and reports.

Ms. Clough will be responsible to ensure that the investigation is performed under the appropriate health and safety standards. Ms. Clough will manage the health and safety aspects of the RFI in accordance with Health and Safety Plan (Section 6).

The health and safety effort will include assessment of site conditions and potential hazards, as well as enforcement of established field directives including safe work zones, work rules, personnel protection, personnel environmental monitoring, decontamination procedures and field medical monitoring.

#### 9.2.6 Public Relations

The Public Relations Manager is Ms. Tina Dailey. Ms. Dailey has more than 11 years of experience in public/community relations, public speaking, writing, editing, and marketing. She has two years of experience as a reporter and editor for newspapers and radio stations. Her experience ranges from developing and producing newsletters, information brochures and graphics presentations to conducting motivational and professional image workshops.

Ms. Dailey's responsibilities will be to coordinate the public's knowledge of and involvement with the RFI and the corrective action process. Ms. Dailey will perform her duties in compliance with the site-specific Public Involvement Plan (Section 10).

The public relations/public involvement aspects of this project will include communicating accurate information to the public (employees, citizens, local officials and media) about the RFI process, providing updates on site progression, and providing concerned parties with opportunities for comments/responses on site issues.

#### 9.2.7 Risk Assessment

The risk assessment process will be under the management of Mr. Paul Carter. Mr. Carter will be responsible for coordination of risk assessment activities and for performing the human health risk assessment. Dr. Barney Cornaby will be responsible for performing the ecological risk assessment.

Mr. Carter has five years of experience performing risk assessments in support of investigations at hazardous waste sites. He has experience in assessing risks from contaminants, identifying human and ecological receptors, identifying contaminants of concern, establishing cleanup levels, and evaluating risks during implementation of remediation activities.

Dr. Cornaby is an environmental risk assessment practitioner with more than 20 years experience in ecological risk assessment, environmental toxicology, and environmental assessments. He has completed a variety of field studies, laboratory analyses, and literature syntheses involving both non-human populations and ecological systems. He applied his knowledge in developing such tools as hazard and risk comparison schemes for ranking chemicals for the United States Environmental Protection Agency.

The risk assessment team will be responsible for preparing the risk assessment that will be incorporated into the RFI report. The risk assessment will be performed in accordance with appropriate Federal and State regulatory guidelines.

#### 9.2.8 Engineering Support

Ms. Debra Engelgau is a certified professional engineer with 14 years of experience in hazardous waste management, compliance evaluations, and remedial technology evaluations. Her experience includes developing and evaluating remedial action alternatives for over 20 contaminated sites.

Ms. Engelgau will be managing the engineering evaluation for the Corrective Technology Plan, included as Section 12 of this RFI Work Plan and for evaluation and implementation of correction measures.

#### 9.3 KEY PERSONNEL

Resumes of the key personnel involved in the RFI are included in Appendix 9A.

Appendix 9A

## Appendix 9A

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#### **GEORGE RICHARD CARTER**

#### **EDUCATION:**

M.S., Zoology, Ohio State University, 1985, 3.5 GPA B.S., Environmental Biology, Ohio University, 1980, 3.3 GPA

#### WORK SUMMARY:

Mr. Carter is senior Environmental Scientist with the SAIC Columbus, Ohio office. He has over thirteen years of environmental regulatory experience in RCRA Subtitle C and D, CERCLA, Clean Air Act, Clean Water Act and Toxic Substances Control Act, including eight years of environmental regulatory and management experience at Ohio EPA. Mr. Carter provides project management and technical support to U.S. DOE and DoD and various commercial clients. Mr. Carter is a Certified Professional under the Ohio EPA Voluntary Action Program (Brownfields).

#### **PROFESSIONAL EXPERIENCE:**

November 1996 to Present, Senior Environmental Scientist, SAIC. Mr. Carter provides project management and support on SAIC projects at the Portsmouth, Fernald, Mound and Wright Patterson Air Force Base facilities as well as commercial clients. He conducts extensive work in areas of RCRA compliance (closure plans, waste characterization and management, regulatory issues), RCRA Corrective Actions (RFA/RFI/CMS), CERCLA (RI/FS), air regulatory compliance (Air RFI, Clean Air Act), NESHAP, TSCA (PCBs), solid waste (solid waste closure plans, Permits to Install, regulatory issues), environmental audits, site sampling/field investigation and other regulatory compliance issues.

February 1993 to November 1996, Manager - Site Investigation and Compliance Section, SAIC. Mr. Carter provided project management and support on SAIC projects at the Portsmouth, Fernald, Mound and Wright Patterson Air Force Base facilities as well as commercial clients. He conducted extensive work in areas of RCRA compliance, RCRA Corrective Actions, CERCLA (RI/FS), air regulatory compliance, NESHAP, TSCA (PCBs), solid waste, environmental audits, site sampling/field investigation and other regulatory compliance issues. As Site Investigation and Compliance Section Manager, Mr. Carter was responsible for personnel oversight, staff mentoring, conducting employee evaluations, and salary planning.

January 1992 to January 1993, Senior Environmental Scientist, SAIC. Mr. Carter provided project management and support to SAIC projects at the Portsmouth, Mound, Fernald and Wright-Patterson Air Force Base facilities. He conducted extensive work on RCRA Closure Plans, RCRA Corrective Actions (RFA/RFI/CMS), CERCLA (RI/FS), Clean Air Act, NESHAP, TSCA, solid waste and other regulatory compliance issues.

October 1987 to January 1992, Assistant Administrator, Ohio Environmental Protection Agency (Ohio EPA), Division of Emergency and Remedial Response. Mr. Carter managed Toxic Substance Control Act (TSCA), radiological response, enforcement and SPCC programs. Responsibilities included management of polychlorinated biphenyl (PCB) and hexavalent chromium compliance and monitoring activities, serving as Ohio liaison on TSCA matters with State and federal government, management of nuclear power plant regulatory oversight and emergency response program, management of SPCC inspection and regulatory program, and management of Divisions enforcement activities. Member of the Forum on State and Tribal Toxic Actions (FOSTTA) advisory board to U.S. EPA. Served as on-scene coordinator in oil, hazardous material, and PCB spill cleanup.

September 1986 to October 1987, Solid Waste Enforcement Coordinator, Ohio EPA, Division of Solid and Hazardous Waste Management. Coordinated solid waste compliance/enforcement activities for Ohio. Served as Ohio EPA representative in State and local government solid waste matters.

March 1984 to September 1986, Environmental Scientist 2, Ohio EPA, Office of Emergency Response. Conducted PCB compliance inspections, provided technical advice/support regarding PCBs and responded to and supervised cleanup of PCB, oil, and hazardous material spills.

March 1980 to March 1984, Graduate Research Associate, Ohio State University, Department of Zoology. Surveyed and analyzed fish populations of the Ohio River. Duties included supervision of technicians.

March 1980 to March 1984, Graduate Teaching Associate, Ohio State University, Department of Zoology. Taught laboratories in ichthyology, biology of fishes, fish ecology, and general zoology.

#### **COMPUTER PROFICIENCY:**

WordPerfect 6.1 Excel

#### **MISCELLANEOUS:**

Ohio EPA Director's Award for Image Awareness, 1990.

Specialized Training:

"Introductory to Groundwater Modeling," U.S. EPA, 1987.

"40-Hour Training for Emergency Response," University of Findlay, 1988.

"OSHA Safety Training for Supervisors," U.S. EPA, 1988.

"Radiological Health and Safety," Ohio Emergency Management Agency, 1989.

"Basic Inspectors Training," U.S. EPA, 1990.

"Principals of Incident Command," Ohio State Fire Marshal's Office, 1990.

"Project Management," SAIC, 1992.

"Fixed-Price Project Management," SAIC, 1992.

#### **CUSTOMERS:**

Department of Energy (DOE) Department of Defense (DoD) Martin Marietta Energy Systems (MMES) Franklin Steel Company Ohio Environmental Protection Agency (Ohio EPA) Airport Manufacturing OHM Corporation U.S. Army Corps of Engineers

#### PAUL E. CARTER

#### **EDUCATION:**

M.S. Zoology, Miami University, 1993, 4.0 GPA B.S. Zoology, Miami University, 1991, 3.8 GPA

#### WORK SUMMARY:

Mr. Carter has 5 years of experience as an environmental scientist. His primary duty has been the performance of risk assessment activities for site investigations of hazardous waste sites. He has worked in all phases of site risk assessments from the development of Preliminary Remediation Goals for use in preliminary site assessments to full Baseline Risk Assessments. Mr. Carter has experience assessing risks from contaminants at hazardous waste sites, identifying human and ecological (nonhuman) receptors, identifying Contaminants of Concern, establishing Cleanup Levels, and evaluating risks from remediation activities. In addition, Mr. Carter is a trained wetland delineator. He prepares wetland permits (Section 404 and 401) and performs characterizations of the ecological resources present at sites under investigation. He is skilled in the use of spreadsheet and word processing software.

#### **PROFESSIONAL EXPERIENCE:**

August 1993 to present, Risk Assessment Specialist, SAIC. Mr. Carter is responsible for conducting risk assessment activities including the development of risk calculation spreadsheets, writing text for risk assessments, performing ecological characterizations, and review of documents. Responsibilities have included the performance of human health and ecological risk assessment/management activities pertaining to Baseline Risk Assessments (BRAs), Corrective Measures Studies (CMS), and Risk-based Closure Plans for RCRA Units including the following tasks: characterization of human health and ecological risks, development of Preliminary Remediation Goals, development of Remedial Action Objectives, writing of Risk Evaluations of Remedial Alternatives, preparing position papers, and review of BRAs. Mr. Carter performed these services for the at the U.S. Department of Energy (DOE) Portsmouth Gaseous Diffusion Plant (PORTS) and Mound facilities, U.S. Army's Fort Benjamin Harrison, and the Luckey Site within the Formerly Utilized Sites Remedial Action Program (FUSRAP).

Ecological services provided by Mr. Carter have included ecological site characterizations and wetland-related activities. Wetland project experience has included delineations at the Tonawanda FUSRAP site and PORTS. He has prepared a State of Ohio Section 401 Water Quality Certification application for the Ohio Army National Guard (OHARNG) and assisted with 404 and 401 applications at FBH. Mr. Carter participated in a habitat survey for threatened and endangered species at PORTS, and a habitat survey for the federally-listed Indian bat (*Myotis sodalis*) at FBH. He assisted with the application of U.S. EPA's Rapid Bioassessment Protocol for macroinvertebrates at the Luckey Site. Mr. Carter is currently leading an effort to map habitats at the 21,419 acre Ravenna Arsenal for the OHARNG in support of the Integrated Training and Management (ITAM) program. This map will be integrated into a geographic information system currently in development for the OHARNG.

Other experience includes preparation of a hazardous waste storage cost analysis, real-time radiological surveys of creek beds using USRADS® system, and an assessment of groundwater contamination all at the PORTS reservation. In addition to work at PORTS, Mr. Carter assisted in the preparation of an Engineering

Evaluation/Cost Analysis Report and Action Memorandums for FBH; preparation of a Facility Response Plan for the U.S. Army's Fort Hood, TX; and writing and review of human health and ecological risk assessments for hazardous waste sites in Ohio such as Franklin Steel, Fort Recovery Industries, Fernald, and Coit Road Site.

Miami University, Department of Zoology, Oxford, Ohio, Graduate Assistant, 1991 - 1993, Undergraduate Research Assistant, 1990 - 1991. Mr. Carter conducted independent field and laboratory research in Applied Ecology and Animal Behavior studies for 3 years. He also taught the laboratory portion of an introductory zoology course for one year.

May to June 1990 and May to August, 1989, Assistant Regulatory Analyst, SAIC. As an intern for SAIC's Environmental Technology Group, responsibilities included information management, and the analysis and assembly of data pertaining to various U.S. EPA solid and hazardous waste management programs. Mr. Carter also assisted in the writing of several proposals.

#### **COMPUTER PROFICIENCY:**

IBM PC compatible experience includes: WordPerfect, Microsoft Word and Excel, SESOIL, Quattro Pro, and Netscape Navigator

Macintosh experience includes: Microsoft Word and Excel, Cricket Graph, and Statview

#### **MISCELLANEOUS:**

#### **Training Courses:**

Creation and Restoration of Wetlands, Ohio State University, August 1997.
Wetland Delineation Certification Training, Ohio State University, August 1996.
Radiological Worker I, Portsmouth Gaseous Diffusion Plant
SAIC Division Project Management Training, May 1996.
SAIC Fixed Price Project Management Training, December 1996.
1996 Ohio Wetlands Seminar, Franklin and Fairfield SWCD, March 1996.
8-Hour OSHA Compliance Refresher Training, SAIC, July 1995, July 1996, and March 1998; Emilcott Sept. 1997.
40-Hour OSHA Compliance Training, Ohio University-Chillicothe, September 1994.
Risk Assessment Guidance for Superfund (165.6), U.S. EPA Training Center, Cincinnati, Ohio, June 1994.
Advanced Risk Assessment: Biological & Environmental Modeling, University of Cincinnati, March 1994.

#### **Publications:**

Paul E. Carter and Ann L. Rypstra. 1995. Top-down Effects in Soybean Agroecosystems: Spider Density Affects Herbivore Damage. Oikos 72: 433-439.

Ann L. Rypstra and Paul E. Carter. 1995. The Web-Spider Community of Soybean Agroecosystems. Journal of Arachnology 23: 135-144.

Paul E. Carter and Ann L. Rypstra. 1993. Effects of Spider Density Manipulations on Pest Damage to Soybeans. 1993. Bulletin of the Ecological Society of America 74 (2) p 421.

Paul E. Carter and Ann L. Rypstra. 1991. Impact of Spiders on Pest Damage to Soybeans. American Arachnology 44 pp 5-6.

#### **CUSTOMERS:**

Ohio Army National Guard U.S. Department of Energy (DOE) U.S. Army Corps of Engineers U.S. Army Environmental Center Bechtel-Jacobs Franklin Steel Fort Recovery Industries, Inc.

### MARTHA L. CLOUGH

#### **EDUCATION**:

B.S. Environmental and Hazardous Materials Management, The University of Findlay, 1994, GPA 3.8

#### WORK SUMMARY:

Mrs. Clough has five years of experience in environmental compliance and health and safety issues. She has performed site safety officer roles at DOD and DOE sites and functioned as safety oversight during training operations. She has supported the Air Force in conducting inventories of air emissions data under the CAA. Through her academic experience in multimedia audits and inspections she has a working knowledge of RCRA, CERCLA, NEPA, CWA, CAA, and EPCRA regulations, as well as studies in industrial processes. She holds current training certifications in OSHA 40 HAZWOPER; 8 Hour Refresher; 8 hour Supervisor; Hazardous Materials Technician, Emergency Response; Safety Officer Specialist, Emergency Response; Dräger PA 80 Level 1 Service Technician; and Red Cross First Aid.

#### **PROFESSIONAL EXPERIENCE:**

# Summers 1991, 1992 and 1993 (Intern); June 1994 to present, Environmental Health & Safety Specialist, SAIC.

As an Environmental Safety Specialist, Mrs. Clough is responsible for the writing and implementation of environmental restoration safety and health programs and site specific health and safety plans for DOE and DOD sites. She has overseen many sampling events including drilling operations using HSA, air rotary and geoprobe applications; groundwater sampling and monitoring well installation; and has also served as safety oversight during confined space entries. Her day to day responsibilities while serving in this function include:

- calibration and maintenance of health and safety monitoring equipment;
- conducting pre-entry and daily tailgate safety briefings;
- maintaining on-site auditable documentation of MSDSs, worker training, and exposure monitoring results;
- investigating accidents and near accidents; and
- conducting periodic safety inspections of the work site.

She has served, or is currently serving, as the Site Safety and Health Officer on the following projects:

- Luckey Site Phase IV RI, USACE
- Ravenna Army Ammunition Plant RI, USACE
- Fort Benjamin Harrison EI Phase II, AEC
- Oxford Nike Missile Site CD-78, ACE
- South Dakota Air National Guard SI, NGB
- Anniston Army Depot SIA RI Phase II, AEC
- Portsmouth Gaseous Diffusion Plant Drum Survey, DOE
- Wright Patterson OU7 Preliminary RI Activities, DOD
- EG&G Mound Plant OU5, DOE
- Wright Patterson OU3 RI, DOD

She is also responsible for maintaining current OSHA training certification and medical monitoring surveillance for all employees in Division 513.

Mrs. Clough has played a key role in the team that developed and verified baseline air emissions inventories as part of the Title V air permit application preparation for Wright Patterson Air Force Base. Her responsibilities and duties as part of that team included:

- Verification of the existing AQUIS database by confirming imputed data through site visits, personnel interviews, and reviewing existing records;
- Identification of new sources through site visits and personnel interviews; and
- Training of personnel to perform the above duties.

Processes and facilities where air emissions were evaluated included:

- Jet, airplane and vehicle maintenance;
- Heating and cooling systems such as industrial boilers and cooling towers;
- Generators;
- Painting operations;
- Medical and research processes including laboratory hoods;
- Flammable storage; and
- Office and administrative buildings.

Mrs. Clough has conducted industrial hygiene surveys including Indoor Air Quality Surveys, and industrial hygiene surveys in the hospital setting. She has performed compliance inspections for Anesthetic gas machines and ETO sterilizers.

Mrs. Clough is also a technical writer. She has written and coordinated the writing of Site Investigation reports for the National Guard Bureau, and Environmental Investigations for the Army Environmental Center.

Fall of 1991 to Spring of 1994, Environmental Resource Training Center, The University of Findlay. As an Environmental Resource Student Trainer, Mrs. Clough served as the breathing apparatus technician for the ERTC. Her responsibilities included the maintenance, scheduled testing, and repair of all breathing apparatuses used at the training facility including SCBA units and APR masks. As part of her responsibilities, she maintained a working stock of equipment and spare parts, developed and maintained a system for documentation of all repairs and maintenance, and trained others in the use and testing of the breathing apparatus. Mrs. Clough's duties also included assisting in the hands on training of all OSHA HAZWOPER and Emergency Response courses taught at the University including 40 Hour and 8 Hour Refreshers (29 CFR 1910.120), and Confined Space to both university students and industrial workers. This included the set up of training scenarios and safety oversight while students were in protective equipment. She also served as the team leader of student assistants coordinating work schedules and training new workers in their everyday duties.

#### **COMPUTER PROFICIENCY:**

Computer experience includes: DOS, Microsoft Windows, WordPerfect 5.1 and 6.0, Microsoft Word, Microsoft Excel

#### MISCELLANEOUS:

40-hour OSHA HAZWOPER Training (29 CFR 1910.120) 8-hour OHSA HAZWOPER Refresher (29 CFR 1910.120) OSHA Site Supervisor Emergency Response Technician Training Emergency Response Specialist, Health and Safety Officer Training Dräger PA 80 Self Contained Breathing Apparatus Level 1 Service Technician Red Cross First Aid and CPR

#### CUSTOMERS:

Department of Defense Department of Energy

#### **BARNEY W. CORNABY**

**EDUCATION:** 

Ph.D., Ecology, University of Georgia, 1973

M.S., Zoology/Statistics, Brigham Young University, 1971

B.S., Zoology/Portuguese, Brigham Young University, 1967

#### WORK SUMMARY:

Dr. Cornaby is an environmental risk assessment practitioner with more than 20 years experience in ecological risk assessment, environmental toxicology, and environmental assessments. He has completed a variety of field studies, laboratory analyses, and literature syntheses involving physical, chemical, and biological stressors that affect non-human populations and ecological systems. He applied his knowledge in developing such tools as hazard and risk comparison schemes for ranking chemicals for the United States Environmental Protection Agency (U.S. EPA). This work is similar to the current investigations on chemicals of concern, exposure assessment, toxicity assessments, risk characterization, and risk management he is doing for the Department of Defense (DoD), Department of Energy (DOE), and other clients. His leadership and decisive management skills include goal definition, delegation, follow-up, and evaluation of the quality of the work of individuals and teams. He has experience developing sound work plans and directing and systematically linking sections of small and large environmental compliance programs to maximum output. Dr. Cornaby has conducted environmental research in all major types of ecosystems in the United States, including wetlands and estuaries, ponds and streams, deserts and grasslands, alpine systems, forests and farmlands. In addition, he has months of professional experience in the Latin American tropics; he speaks Portuguese and has directed a large technology-transfer project on toxicological and ecological research in coastal Venezuela. He has prepared and presented more than 100 technical papers and presentations about risk, environmental assessments, and related topics. One paper dealt with weight-of-evidence in the etiology of low-frequency human and ecological effects near hazardous waste sites. Another reported a hazard ranking system for chemicals he and others developed for the waste programs in the State of Illinois. Another dealt with the balancing of economic and environmental matters. Another showed how a rigorously prepared ecological risk assessment established higher than traditional clean-up levels and saved the client many tens of millions of dollars. Although the thrust of his professional work has been with terrestrial populations and ecosystems, he understands the operating principles and properties of freshwater and marine systems. He continuously draws on this extensive experience to design and implement innovative and sound experimental programs for solving environmental problems associated with radioactive and hazardous materials, the human health and ecological consequences of this in ecosystems, the costs of any remediation and corrective actions.

#### **PROFESSIONAL EXPERIENCE:**

October 1991 to present, Section Leader, SAIC. Dr. Cornaby leads a multidisciplinary staff of about 15 persons who conduct environmental assessments and ecological risk assessments in support of Remedial Investigation (RI), Feasibility Studies/Environmental Impact Statements (FS/EISs), and related compliance documents for waste site remediation and restoration for DoD and DOE. He has conducted RIs and FS/EISs at one site in New York and two sites in New Jersey. Dr. Cornaby has also developed a site-wide ecological risk program plan for the DOE for the Savannah River Site. He has been involved with formal baseline risk assessments (BRAs) since October 1991. He is one of the principals for the Tooele, Utah, and the Alabama Army Ammunition Plant, Alabama sites, with mixed wastes where both human and

ecological risk projections are being developed. Other sites are in Georgia, Ohio, Illinois, Indiana, Tennessee, Kentucky, Massachusetts, Michigan, and South Carolina. He also serves as either task leader or project leader on such studies. These problem-solving activities clarified clean-up levels and helped clients meet compliance requirements on time and with confidence.

March 1989 to September 1991, Research and Development Manager/Department Manager, Battelle. Before his current role at SAIC, while he was at Battelle's Columbus Division in Columbus, Ohio, Dr. Cornaby managed the operations of over 50 professional staff members who were at three locations in the Eastern United States performing aquatic, terrestrial, and microbial bioassays and experiments and environmental evaluations. He has led numerous technically complex projects such as: a 3-year 2.4 million dollar pond study for chemical registration of a product; chemical effluent measurements using various bioassays; and environmentally compatible components in products and packaging. During this period he also managed internal research and development projects totalling \$2.0 million per year for Battelle's Health and Environment Group; these projects ranged from environmental effects of products and processes through waste treatment technology development to environmental chemistry methods and product life-cycle analysis. He has developed and applied methods and data for screening, inventory, and impact components of product life-cycle analysis. These investigations gave his company a competitive and innovative edge in the marketplace.

November 1985 to February 1989, Program Manager, Battelle. Dr. Cornaby led a large program at Battelle involving 25 field and 20 laboratory back-up persons at a time. This work involved an off-site laboratory and chain-of-custody flow of thousands of samples to several laboratories. The program culminated technically in risk projections for a variety of organisms receiving contaminants from air, water, and food pathways. This work and subsequent report met all EPA-driven deadlines and allowed the client to continue selling the pesticide worldwide. This program experience provides Dr. Cornaby with real-world knowledge and skill so crucial for the judgements, interpretations, and quality work in risk investigations and environmental site assessments for the National Environmental Policy Act (NEPA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), Clean Water Act (CWA), and other integrated compliance responsibilities.

July 1979 to October 1985, Senior Research Scientist, Battelle. As principal investigator in the synthesis of biological principles, Dr. Cornaby provided a logical and powerful approach for assessing effects of multimedia emission streams from new technologies. He also led a project to extend this method to conventional combustion systems. He developed another regional-level method for a large watershed and introduced it to Brazil. Recently, the system structure and revised scoring system has been adapted to ecological risk evaluations for hazardous chemicals. Throughout, these projects were delivered on time and within budget and, in turn, allowed clients to meet their deadlines and make their decisions with confidence.

August 1973 to June 1979, Research Scientist, Battelle. Dr. Cornaby was responsible for conducting a comprehensive field program on soil, water, vegetation, and animals as they are affected by gas pipelining activities in the Gulf Coast states. He developed mathematical models for the movement of cadmium and other toxicants in the human environment. He analyzed radiation problems at a power plant facility and organized a two-day symposium on toxic substances in ecosystems. He also served as project leader and/or a principal investigator on a variety of technical assessments of energy technologies, including fluidized-beds, coal cleaning, coal gasification, oil-burning power plants, and development of a first-of-its-kind guide to mathematical models associated with power plants. He was a key team member on an environmental impact statement for a water reservoir in West Virginia. He has investigated the effects and risks of pathogens and chemicals together. This combined experience allows Dr. Cornaby to

analyze, understand and solve complex environmental problems requiring the creative use of knowledge. He is also effective as a team leader of engineers and scientists. These studies, especially the ones for commercial clients, provided protection from lesser informed critics, saved money or permitted the more rapid development of a business than would otherwise have been possible.

September 1970 to August 1973, Research Assistant, University of Georgia. Dr. Cornaby designed and conducted soil biogeochemical research within the context of forest ecosystem characterization and systems modeling with the U.S. International Biological Program. He coordinated parts of course work in graduate-level courses of biology and ecology. The knowledge of systems helped him think in terms of flows of matter, energy, and information among the many compartments of the environment.

#### **COMPUTER PROFICIENCY:**

PC experience includes WordPerfect and Excel.

#### MISCELLANEOUS INCLUDING SELECTED PUBLICATIONS/PRESENTATIONS:

Member, Society of Environmental Toxicology and Chemistry, 1985 to present.

Member, Society for Risk Analysis, 1991 to present.

Member, Ohio Biological Survey, 1980 to 1991.

- Member, Ecological Society of America, 1970 to 1985.
- Member, Tropical Biology Association, 1975 to 1990.
- Chairman, Ecology Symposium, Ohio Academy of Science, On Taming the Medusa: Toxic Substances in Our Ecosystems, Columbus, Ohio, 1980.

Member, Steering Committee of Ecology Section, Ohio Academy of Science, 1977, 1979.

- Member, Expert Working Group on Terrestrial Monitoring of Environmental Materials and Specimen Banking, U.S. Department of Energy, Germantown, Maryland, 1978.
- Member, Organizing Committee, Meetings of the Society of Environmental Toxicology and Chemistry, 1992.

Author/co-author of over 75 technical publications, 2 books, and 100 technical presentations.

Burns, T. P., B. W. Cornaby, S. V. Mitz, and C. T. Hadden. 1998. A Probabilistic Interpretation of the *Quotient Method for Characterizing and Manageing Risk to Ecological Receptors*. Superfund Risk Assessment in Soil Contamination Studies: Third Volume, ASTM STP 1338, K. B. Hoddinott, Ed., American Society for Testing and Materials.

Cornaby, B. W., T. P. Burns, C. T. Hadden, and S. V. Mitz. 1997. Use of bioassays in setting risk-based clean-up levels for metals and explosives at an ammunition plant. Society for Risk Analysis, December 7-10, Washington, D.C.

Cornaby, B. W., T. P. Burns, C. T. Hadden, S. V. Mitz, C. D. Samson, and A. N. Wickline. 1996. Ecological risk assessment and development of site-specific remedial goal options for explosives and metals to protect ecological receptors at an ammunition plant. Workshop on Ecological Risk Assessment and Military related Compounds: Current Research Needs, July 31-August 2, Denver, CO.

Cornaby, B. W., et al. 1996. Site-specific preliminary remediation goals for explosives and metals to protect ecological receptors at an abandoned ammunition plant. National Association of Environmental Professionals, June 2-6, Houston TX.

Hadden, C. T., B. W. Cornaby, and F. A. Zafran. 1996. Remediation goals for human and ecological exposure to soil mercury at East Fork Poplar Creek, Oak Ridge, Tennessee. Fourth International Conference on Mercury as a Global Pollutant, August 4-8, Germany.

Burns, T. P., C. T. Hadden, B. W. Cornaby, and S. V. Mitz. 1996. A food web model of mercury transfer from stream sediment to predators of fish for ecological risk-based clean-up goals. Environmental Toxicology and Risk Assessment (sixth volume), ASTM STP 1317. F. J. Dwyer, T. P. Doane, and M. L. Hinman, Eds. American Society for Testing and Materials.

Rao, V. R., S. V. Mitz, C. T. Hadden, and B. W. Cornaby. 1996. Distribution of contaminants in aquatic organisms from East Fork Poplar Creek. Ecotoxicology and Environmental Safety. 33: 44-54.

Burns, T. P., B. W. Cornaby, and C. T. Hadden. 1995. Estimating risk to ecological receptors from contaminated soil at superfund sites. Proceedings of Second Symposium on Superfund Risk Assessment In Soil Contamination Studies, 20 pp.

Suter, G. W. II, B. W. Cornaby, C. T. Hadden, R. N. Hull, M. Stack, and F. A. Zafran. 1995. An approach for balancing health and ecological risks at hazardous waste sites. Risk Analysis 15(2): 221-231.

Zafran, F. A., B. W. Cornaby, and C. T. Hadden. 1995. Invited paper: Human and ecological remediation goals for soil mercury at East Fork Poplar Creek, Oak Ridge, TN. Society of Environmental Toxicology and Chemistry, November, Vancover, British Columbia, Canada.

Cornaby, B. W., T. P. Burns, C. T. Hadden, S. V. Mitz, and P. F. Ryan. 1994. Spatial analysis in ecological risk assessment. Society for Risk Analysis, December 4-7, Baltimore, MD.

Cornaby, B. W., S. V. Mitz, C. T. Hadden, and T. P. Burns. 1993. Weight-of-evidence applications in ecological risk assessment. Society for Risk Analysis, December 5-8, Savannah, GA.

Cornaby, B. W., K. L. Daniels, C. T. Hadden, S. V. Mitz, W. J. Rogers, and D. G. Page. 1992. Ecological risk assessment and remedial investigations of populations, communities and ecosystems along East Fork Poplar Creek, Oak Ridge, TN. Nuclear Hazardous Waste Management International Topic Meeting, August 23-27, Boise, ID. Vol. 1: 815-818.

Hadden, C. T., D. W. Combs, B. W. Cornaby, M. Cunningham, J. P. Groton, Jr., and C. R. Wenzel. 1992. Contaminant and habitat heterogeneities in floodplain ecosystems of East Fork Poplar Creek, Oak Ridge, Tennessee. Society of Environmental Toxicology and Chemistry, November 8-12, Cincinnati, OH.

Cornaby, B. W., J. W. Chason, D. W. Combs, K. L. Daniels, C. T. Hadden, T. P. Hanrahan, S. V. Mitz, W. J. Rogers, W. W. Tolbert, P. Cole, and D. G. Page. 1992. *Weight-of-evidence ecological risk assessment for floodplain ecosystems of East Fork Poplar Creek*, Oak Ridge, TN. The 8th. Annual Oak Ridge Model Conference on Waste Management and Environmental Restoration, October 19-22, Oak Ridge, TN.

Duke, K. M., B. W. Cornaby, A. R. Gavaskar, and T.A. McClure. 1991. Criteria for establishing values and estimating costs for ecosystem restoration. Society of Environmental Toxicology and Chemistry, November 3-7, Seattle, WA.

Vigon, B. W., B. W. Cornaby and J. R. Proffitt. 1990. Choosing the preferred environmentally compatible materials: A plan for success. Packaging. December: 20-23.

Cornaby, B. W., J. A. Shuey, and D. A. Tolle. 1990. Implementation of a chemical ranking system. Report to U.S. Environmental Protection Agency, Washington, 77 pp in report, 310 pp in appendix.

Cornaby, B. W., A. F. Maciorowski, J. E. Navarro, S. E. Pomeroy, and J. A. Shuey. 1990. Pesticide Study. Report to industrial client. 2300 pp report.

Cornaby B. W., B. W. Vigon, J. A. Fava, and J. R. Proffitt. 1990. *Environmental solutions using integrated life cycle assessment of products and packaging*. Society of Environmental Toxicology and Chemistry, November 11-15, Arlington, VA.

Cornaby, B. W., Life cycle analysis: A new tool in design. 1990. Industrial Designers Society of America, August 8-11, Santa Barbara, CA.

Cornaby, B. W., D. A. Tolle, J. A. Shuey, J. D. Rench, and W. Banks. 1989. A rapid hazard ranking system for chemicals. 10th. Annual Meeting of the Society of Environmental Toxicology and Chemistry, October 28-November 2, Toronto, Canada.

Cornaby, B. W., N. G. Reichenbach, and L. Fradkin. 1986. Model building for pathogen exposure and risk assessments. ASTM 10th. Aquatic Toxicology and Hazard Assessment Symposium, May 4-6, New Orleans, Louisiana.

Cornaby, B. W., C. J. English, A. R. Buhr, A. B. Cowans, M. S. Lilga, S. J. Maris, D. J. Stallings, and S. J. Turner. 1985. Development of risk assessment methodology for the distribution and marketing of wastewater treatment sludge products. Report to U.S. Environmental Protection Agency, Washington, D.C. 91 pp in report; 33 pp in appendixes.

Fradkin, L., S. Lutkenhoff, J. Stara, E. Lomnitz, and B. Cornaby. 1985. Feasibility of performing a risk assessment on pathogens. J. Water Poll. Fed. Brd., 57 (12): 1183-1188.

Rench, J. D., B. W. Cornaby, R. P. Moffa, and R. L. Shank. 1985. Development and implementation of a new hazard evaluation system for special waste streams. Society of Environmental Toxicology and Chemistry, November 10-13, St. Louis, Missouri.

Cornaby, B. W., K. M. Duke, L. B. Goss, and J.T. McGinnis. 1982. Application of environmental risk techniques to uncontrolled hazardous waste sites. Management of Uncontrolled Hazardous Waste Sites. Hazardous Materials Control Research Institute, Silver Springs, Maryland. Pp. 380-384.

Cornaby, B.W. (editor), 1981. Management of toxic substances in our ecosystems: Taming the Medusa. Ann Arbor Science Publishers, Inc., Ann Arbor, MI. 186 pp. Cornaby, B.W. 1980. Biological pathways, transformations, and ecosystem effects. Conference on Environmental Risk Assessment: How New Regulations Will Affect the Utility Industry, December 10-11, New Orleans, Louisiana.

Bloom, S.G., B.W. Cornaby, and W.E. Martin. 1978. A guide to mathematical models used in steam electric power plant environmental impact assessment. U.S. Fish and Wildlife, FWS/OBS-78/01, 153 pp.

Cornaby, B. W., L. Pomerantz, K. S. Murthy, H. Nack, and D. B. Henschel. 1977. A conceptual approach to assessing health/ecological effects of toxic substances from coal-burning fluidized-bed combustion systems (FBC). Ecological Society of America, August 21-25, East Lansing, Michigan.

#### **CUSTOMERS:**

Department of Defense (DoD), especially Army Department of Energy (DOE) TINA M. DAILEY

**EDUCATION:** 

M.A., Journalism, The Ohio State University, Columbus, OH, 1989, 3.82 GPA B.A.J., Journalism, The Ohio State University, Columbus, OH, 1985, 3.58 GPA

#### WORK SUMMARY:

Ms. Dailey has more than 11 years' experience in writing, editing, public/community relations, public speaking and marketing. She has more than 3 years of experience in marketing and sales and nearly 2 years of experience as a reporter and editor for newspapers and radio stations. Her experience ranges from developing and producing newsletters, information brochures and graphics presentations to conducting motivational and professional image workshops for high school students and business professionals.

#### **PROFESSIONAL EXPERIENCE:**

October 1995 to present, Community Relations Specialist, SAIC. Ms. Dailey performs various tasks in support of the community relations program for the Environmental Management and Enrichment Facilities at the Portsmouth Gaseous Diffusion Plant near Piketon, Ohio. In this position, she is responsible for writing and designing a bimonthly employee newsletter, a semiannual environmental bulletin that is disseminated to nearly 5,000 recipients, and various public information materials, such as fact sheets, news releases and story boards, to provide an update on the cleanup program at the plant. She coordinates all of the hands-on educational activities for nearly 3,000 sixth grade students at the annual EnvironMENTAL Fair in Portsmouth. She also orders all of the supplies and promotional materials for the fair and coordinates a majority of the fair site logistics and facilities requirements. She assists in organizing public meetings and public availability sessions. Ms. Dailey has served as a note taker at several public meetings and Department of Energy (DOE) Decision Team meetings. In addition, she designs, edits and oversees the printing of the DOE Annual Environmental Report for the Portsmouth site.

February 1995 to September 1995 and May 1987 to September 1987, Admissions Representative, Southeastern and Lorain Business Colleges. Ms. Dailey managed the print, radio and television advertising efforts for the Chillicothe branch of the college and disseminated information packets about the Marion campus to increase public awareness. She also contacted prospective students for enrollment to the college.

July 1993 to February 1995, Human Resource Consultant, Personnel Solutions. In this position, Ms. Dailey compiled a mailing list of more than 500 area businesses, wrote and designed marketing letters and brochures, and conducted sales calls to encourage companies to use these human resource services.

February 1992 to June 1993, Accounts Receivable Clerk, The Christian Armory. Ms. Dailey established charge accounts for customers and managed receivables and collections. She also processed the biweekly payroll both manually and electronically.

March 1990 to February 1992, Marketing Coordinator, Limited Credit Services. In this role, Dailey managed direct mail marketing programs aimed at acquiring new credit customers and encouraging existing customers to buy. She wrote marketing program designs and time and action schedules, prepared budgets and expense variance reports, and supervised the creation and printing of promotional pieces, such as letters, coupons, postcards, signs, credit cards and credit applications.

October 1989 to March 1990, Customer Service Representative, Limited Credit Services. Ms. Dailey handled customers' mail and telephone inquiries regarding their charge accounts.

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September 1988 to September 1989, Journalism Student Counselor, The Ohio State University. Ms. Dailey earned this associateship position, which she held throughout her year in graduate school. She assisted undergraduate journalism students in selecting courses and conducted tours of the School of Journalism for prospective students.

May 1988 to September 1988, Newscaster, WBEX/WKKJ Radio. In this position, Ms. Dailey wrote, produced and reported news and feature stories on both radio stations.

August 1986 to May 1988, Workshop Coordinator, Southeastern and Lorain Business Colleges. Ms. Dailey conducted motivational and professional image workshops for high school students and business professionals throughout Ohio, Kentucky and West Virginia as a public relations tool for the college.

June 1985 to July 1986, Assistant Editor/Freelance Writer, Newslife. In this position, Ms. Dailey wrote feature and cover stories, edited copy and assisted with layout of a biweekly newspaper. She also took photographs, developed film and printed pictures.

#### **COMPUTER PROFICIENCY:**

Macintosh experience with Pagemaker, Freehand, WordPerfect, Photoshop, Excel and Microsoft Word. IBMcompatible experience with WordPerfect, Excel and Microsoft Word.

#### **MISCELLANEOUS:**

Specialized training received in Community Relations and Risk Communications.

#### **CUSTOMERS:**

U.S. Department of Energy (DOE) Bechtel Jacobs Company LLC

#### DAVID E. KORNS

#### **EDUCATION:**

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B.Sc., Nuclear Engineering, University of Cincinnati, 1986

#### WORK SUMMARY:

Mr. Korns is the manager for the Environmental Information Management and Technology Section in SAIC's Environmental Compliance & Assessment Division. In this position, he has managed a variety of projects for several different clients in all facets of environmental data management. Currently, Mr. Korns oversees the environmental data management process for several government and commercial facilities. Project activities include sample and analysis planning, data collection and tracking, data analysis and reporting, spatial analysis and software development. Mr. Korns manages the Information Technology (IT) needs for 270 employees across several SAIC offices. He has developed the division's wide area network (WAN) by connecting the local area networks at each of the three Ohio offices. The WAN includes Internet e-mail and world wide web access. In the past, Mr Korns's non-environmental work has included computer analysis models, programs and prototypes for the Department of Energy's (DOE's) Oak Ridge and Savannah River Plants, Office of Civilian Radioactive Waste Management, Pittsburgh Energy Technology Center, and the Nuclear Regulatory Commission.

#### **PROFESSIONAL EXPERIENCES:**

1984-present, SAIC, Manager Information Management and Technology Section, Environmental Compliance & Assessment Division. SAIC - As section manager, Mr. Korns manages an environmental staff which specializes in environmental data quality, data analysis, geographical information systems, web based database technology and information technology throughout the Midwest. He oversees the information systems for three Ohio offices, two Pennsylvania offices and one office in Maryland. His section is involved with environmental data collection, database development, and statistical analysis; comprehensive environmental data quality assessments through data validation; spatial data analysis and mapping utilizing a geographic information system (GIS); and three dimensional geospatial visualization.

For the Portsmouth Gaseous Diffusion Plant (Portsmouth, Ohio), Mr. Korns currently supports the handling of environmental monitoring, compliance, and restoration information. His staff manages over 50,000 groundwater results per year for an annual report. His staff also provides Geographic Information System (GIS) support and three dimensional geospatial visualization for all Portsmouth groundwater activities. Mr. Korns' staff has authored the Portsmouth OREIS Data Management Plan and Project Management Plan. OREIS is a consolidated environmental information management system for DOE-Oak Ridge and will be utilized as the site's repository of all environmental data.

For the law firm Thompson, Hine and Flory (Cleveland, Ohio), Mr. Korns managed the conversion of all historic environmental data into a consolidated database system. His staff converted several boxes of hardcopy environmental data from characterization activities at a site into a 50,000 record database. This allowed THF staff to query, sort and organize data by chemical, location, and concentration.

For the DOE Mound Environmental Restoration Program (Miamisburg Ohio), Mr. Korns managed the collection of all historic environmental data into a consolidated database system (MEIMS). His staff collected environmental data from Mound contractors and consolidated them into one system. The system maintains over 700,000 chemical results analyzed from over 8,000 spatial locations. Over 36,000 documents have been indexed and maintained in a Document Management System.

For the Bethelehem Steel Corporation, (Bethlehem, PA), Mr Korns oversees the data management for data collection, analysis and reporting for data collected at the Bethlehem Steel Lehigh Plant. Over 300 samples generated 15,000 analytical results reported over two phases of field work at one of the Lehigh areas.

For the Corps of Engineers, (Ft. Hood Texas), Mr Korns oversees the data management for all aspects of data collection, analysis and reporting for a RFI. Over 1000 samples generated 150,000 analytical results reported over four phases of field work.

For the Wright-Patterson Air Force Base OU3 RI/FS project (Dayton, Ohio), Mr. Korns was involved in the implementation of SAIC's Environmental Information Management System. The system tracked the entire flow of data from sample creation to validated analytical results. He managed the CAD/GIS staff in support of the RI report which included over 100 unique maps and drawings from geologic cross sections to contaminant plumes.

For the Coit Road RI/FS (Cleveland, Ohio), Mr. Korns developed a data management system to support the risk assessment effort which contained all RI and background sample information and laboratory results. After the RI data were validated by SAIC, he developed data analysis summaries, comparison to background, and the list of contaminants of concern.

For the Army Corp of Engineers (COE), Mr. Korns developed the sampling and analysis database for the Monongahela River study in Pennsylvania. Samples were collected and tracked from over twenty different locations along the river. After the samples were analyzed for target compounds and analytes, the data were loaded, summarized and compared against Pennsylvania Department of Environmental Resources (PDER) standards.

For the Nuclear Regulatory Commission (NRC), Mr. Korns developed a LOTUS 123 statistical analysis model that evaluated nuclear power plant component failure data for several nuclear power plants. The system analyzed data for aging trends, generated statistical values for aging rates, confidence bounds and goodness of fit, and plotted failure rate verses age.

For the Department of Energy's Savannah River Plant (South Carolina), he developed a prototype expert system for proper classification of hazardous materials that are shipped from the Savannah River site. A rule based system guided S.P., personnel through DOT, RCRA and CERCLA requirements. He also developed a Lotus 1-2-3 Monte Carlo simulation of the effect of cold weather on the shipments of Uranyl Nitrate Hexahydrate from the Savannah River Plant. Eleven random variables were sampled independently for calculating the conditions effecting the arrival temperature of the shipments.

For the Department of Energy's Y-12 Plant (Oak Ridge, Tennessee), he analyzed the effect of the heat generated by the decay of nuclear materials transported in shipping containers. These analyses were included in Safety Analyses Reports for Packaging (SARPs). Mr. Korns also reviewed radiation shielding analysis for the same shipping containers.

For the DOE's Oak Ridge Operations sites, Mr. Korns studied the feasibility of automated mapping for the Emergency Operation Center computers. Electronic maps were selected for content and compatibility. Electronic USGS maps were selected for the PORTS facility. For the Office of Civilian Radioactive Waste Management he developed a prototype document header classification system for the DOE Licensing Support System (LSS) catalogers. He interpreted the system requirements and developed a prototype which used rules for proper screening of input data as it was typed into a database. Mr. Korns also developed a Comment Tracking System for the Nevada Nuclear Waste Storage Investigations high level nuclear waste repository project. He collected system requirements from observing NNWSI personnel and successfully accommodated comments from over 100 reviewers and generated printed reports for reviewers, disciplines and A/E's as well as summary sheets. He also developed the Information Needs/Site Characterization Tests knowledge base for the Department of Energy Salt Repository Project (SRP) Site Characterization Program. He applied a knowledge base (expert system) tool. The tool used a dynamic database with current information, general S.P. knowledge, and rules relating knowledge shared by S.P. programs to provide solutions for a user query's regarding information needed to resolve project issues.

As an engineering assistant, Mr. Korns supported the pressurized thermal shock analyses of two nuclear power plants. He developed a support system interaction analysis for the development of overcooling sequences. He also contributed to the development of various Safety Analysis Reports (SARs) for the Savannah River Plant. SARs were developed for burial grounds, process facilities and for the transportation of hazardous materials.

 Nuclear Utilities, Engineering Assistant - Mr. Korns supported the reactor core safety and transient analysis divisions for the Cincinnati Gas and Electric and Public Service Electric and Gas companies. In this role, he developed thermal hydraulic models for computer analysis of nuclear reactor cores. He designed computer models for the feedwater/level and pressure control for a Boiling Water Reactor (BWR) and assisted in the verification of reactor core channel analysis models for a Pressurized Water Reactor (PWR).

#### **COMPUTER PROFICIENCY:**

SOFTWARE EXPERIENCE: dBASE, CLIPPER, FOXPRO, LOTUS 1-2-3, DOS, BASIC, TURBO PROLOG, MS-FORTRAN, VMS FORTRAN, ORACLE

HARDWARE EXPERIENCE: IBM MAINFRAME AND PC, VAX, MICROVAX, MACINTOSH, PC COMPATIBLE

#### **MISCELLANEOUS:**

Evaluation of Aging Effects in Component Failure and Maintenance Data, Vesely, W.E., Korns, D.E., Appignani, P.L., Scalzo, S.M. September 1989.

SCP Tools, A Knowledge Base Toolbox for Documenting Relationships Among High-Level Issues and Site Studies Planned for Characterization of a Repository Site, Korns, D.E., Troy, K.S. March 1988.

Safety Analysis, DPSTA-200-10. Evaluation of Accident Risks in the Transportation of Hazardous Materials by Truck and Rail at the Savannah River Plant, Best, R.E., Korns, D.E., et al. October, 1987.

Analysis of Risk of Payload Freezing for Cold Weather Shipments of Uranyl Nitrate Solution Transported in DOT MC312 Insulated Tank Trailers from the Savannah River Plant to Oak Ridge, TN, Best, R.E., Korns, D.E. August 1987. National Groundwater Association

### **CUSTOMERS:**

Department of Energy (DOE) Lockheed Martin Energy Systems (LMES) Department of Defense (DoD) Fort Recovery Wright Patterson Air Force Base MOUND Franklin Steel Drum Thompson, Hine and Flory Bethlehem Steel

#### **STEVEN L. McBRIDE**

#### **EDUCATION:**

B.S., Dual Majors in English and Photography, Minor in Chemistry, The Ohio State University, 1976, 3.2 GPA

#### WORK SUMMARY:

Mr. McBride has over 13 years Quality Assurance/Quality Control (QA/QC) experience in chemical sampling and analysis including supervision of laboratory operations. He is experienced in organic and inorganic data validation including many radiochemical methods. He has experience in leading data validation team efforts including procedure development, training, and coordination of work product submittals. Mr. McBride has written Quality Assurance Project Plans. He also has experience in lab service procurement and coordination and has performed laboratory audits.

#### **PROFESSIONAL EXPERIENCE:**

December 1992 to present, SAIC, Data Validation/Laboratory and QA Coordination. Mr. McBride provided extensive data validation support for various Mclean and Oak Ridge projects, on Department of Energy-Mound, Regional Soils Investigation and assisted in preparation of the Data Quality Assessment. He also provided data validation support for the Canal Special Sampling project for the same client. He provided extensive data validation support on the Wright-Patterson Air Force Base, Operable Unit 3 Remedial Investigation.

As the data validation task leader for the Portsmuth Gaseous diffusion Plant's (Piketon, Ohio) Ground Water Protection Program, Mr. McBride was responsible for coordinating the flow of all validation efforts for a two company team. Technical functions performed in support of this task included defining data validation level requirements, developing a validation reporting system, and training of staff.

As a team member, he has assisted in laboratory audits in support of stringent QA/QC guidelines for obtaining legally defensible data.

Mr. McBride has assisted with the implementation of various program data validation procedures for both government and commercial remediation contracts. He also serves as the Columbus and Waverly offices QA coordinator, participating in various project QA functions, providing assistance as a resource, and reporting QA activities to the Group QA officer.

June 1990 to December 1992, Lab Coordinator, The Ohio EPA. As Lab Coordinator for two Ohio EPA divisions, Mr. McBride managed \$1 million in lab support contracts (state fiscal years 1991 and 1992). He also tracked site specific sampling expenses and filed reports in support of cost recovery efforts. As part of a technical support team, he reviewed sampling plans relative to site specific needs and program priorities to optimize use of lab support dollars statewide. Mr. McBride's responsibilities included assisting in lab service procurement, which involved writing technical specifications and leading laboratory site visits and audits.

1987 - 1990, Organic Technologies, Lab Supervisor, Quality Control.

#### 1984 - 1987, Wiley Organics, Analytical Chemist, Quality Control.

1982 - 1984 Freelance Photographer. Provided promotional material for Ronald McDonald House, Columbus.

1976 - 1982 Research Assistant, Medical Photographer O.S.U. Research Foundation and O.S.U. College of Medicine.

#### **COMPUTER PROFICIENCY:**

Word Perfect, various database and spreadsheet software and applications.

#### **MISCELLANEOUS:**

None

#### **CUSTOMERS:**

Department of Energy (DOE) Department of Defense (DoD)

#### A. BRAD RICHARDSON

#### **EDUCATION:**

B.A., Geology, Ohio Wesleyan University, 1981

#### WORK SUMMARY:

Mr. Richardson has over 14 years of experience in the environmental sciences with particular emphasis in the fields of geology, hydrogeology and engineering. His experience includes technical evaluation of groundwater flow, solute flow, and/or multiphase flow computer modeling of hydrogeologic systems. His work experience also includes planning, implementation, and technical supervision of field investigations of CERCLA, industrial (RCRA), solid/hazardous waste facilities, and oil & gas properties. Recently, he has served as project manager for a solid waste facility closure (at DOE facility) and for a large scale U.S. Army Corp of Engineer investigation; and has co-authored the reports for these projects.

#### **PROFESSIONAL EXPERIENCE:**

November 1992 to present, Senior Project Geologist/Hydrogeologist, SAIC. As a senior project hydrogeologist, Mr. Richardson has provided project support to SAIC projects at the PORTS, Mound, and Wright-Patterson Air Force Base (WPAFB) facilities. He has provided extensive work on Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Remedial Investigation/Feasibility Study (RI/FS) programs by contributing to the expansion of field-based activities on Department of Defense (DOD) and Department of Energy (DOE) hazardous waste sites. He has supervised geological/hydrogeological field activities for operable units at the Mound, WPAFB and U.S. Army Corps of Engineer facilities; field activities included soil gas surveys, soil borings, monitoring well installation, well sampling, and hydrogeological testing. Subsequent data analysis and report writing tasks were undertaken by Mr. Richardson. He has provide project support on commercial industrial facilities in Ohio including Title V/air pollution permitting requirements; developed a Groundwater Quality Assessment Work Plan for a Resource Conservation and Recovery Act (RCRA) surface impoundment facility.

Mr. Richardson has provided three-dimensional groundwater flow and solute transport modeling, as well as DNAPL multiphase flow modeling support to Corrective Measure Studies at the Portsmouth, Ohio, Uranium Enrichment Facility. DNAPL multiphase flow modeling using MAGNAS and solute transport modeling using FRAC3DVS, including calibrating and sensitivity analysis, were performed by Mr. Richardson to determine if cleanup goals could be achieved.

Mr. Richardson has extensively provided technical writing and field management support in developing an RCRA Facility Investigation (RFI) for the Army Environmental Center (AEC) at the Newport Army Ammunition Plant (NAAP) which included phase II and III assessments of soil, groundwater, surface water and sediments for contaminants related to the manufacturing and disposal of various explosives and nerve agents.

December 1989 to November 1992, Project Geologist, Killam Associates. As project geologist, Mr. Richardson has developed and implemented Closure Plans and Groundwater Quality Assessment Plans (GQAP) for RCRA facilities. He has conducted several site assessments for various industrial clients which included groundwater and solute transport/fate assessments; supervised field activities which included soil gas

surveys, soil borings, monitoring well installation, and slug testing; and managed studies of detailed cost analysis for solid waste landfills which included various scenarios to assess the impact of capacity and BAT levels on cost. He has coordinated studies for several captive landfill sites in Ohio, including an evaluation of land disposal restriction requirements for hazardous waste management facilities; conducted several storm water management studies for industrial and construction sites including compliance sampling/analysis of storm water and preparing storm water pollution preventions plans.

November 1987 to December 1989, Project Geologist, R.D. Zande. As project geologist, Mr. Richardson was responsible for development of new and existing solid waste disposal sites: conceptual site design, final plan, and PTI report wiring; directed soils/hydrogeological drilling field operations; reviewed all resultant soils/hydrogeological data from subcontracted consultants; analyzed conclusions and made final design recommendation. He presented hydrogeological seminar to Ohio EPA to explain siting requirements under H.B 592 and assessed geological background of project sites necessary for explosive landfill gas migration analysis and compliance with H.B. 65.

March 1983 to August 1986, engineering Assistant, EMH&T. Mr. Richardson engineered commercial and residential developments including: site layout, storm water management and earthwork balance; also responsible for street, storm sewer, sanitary sewer and water main design for small scale as well as large scale developments.

September 1981 to January 1983, Geologist, Murphy Oil Co. As the geologist, Mr. Richardson was responsible for exploration and production of oil and gas in Ohio, West Virginia, and Pennsylvania. Company field representative: supervised drilling operations, logged Oil & Gas wells.

#### **COMPUTER PROFICIENCY**

IBM-compatible experience includes Word, Word Perfect, Lotus, Excel, SURFER, QuickLog5, and MCAD. Also UNIX (Solaris Operating System) experience.

#### **MISCELLANEOUS:**

Member: Association of Groundwater Scientist and Engineers

### **CUSTOMERS:**

Department of Energy (DOE) Department of Defense (DOD) Lockheed Martin Energy System U.S. Army Corps of Engineers Section 10 PUBLIC INV. PLAN

## PUBLIC INVOLVEMENT PLAN

## **SECTION 10**

## **RCRA FACILITY INVESTIGATION WORK PLAN**

## FOR

## THE SCOTTS COMPANY 14111 Scottslawn Road Marysville, Ohio 43041

June 11, 1999

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#### **10.0 PUBLIC INVOLVEMENT PLAN**

#### **10.1 INTRODUCTION**

This Public Involvement Plan (PIP) has been developed in preparation for public involvement activities that will be conducted during the implementation and upon completion of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at the Scotts Marysville facility in Union County, Ohio. The purpose of this document is to provide an official forum for addressing potential community concerns regarding site environmental issues and a means to enhance communication among local residents; city, county, state, and federal public officials; Ohio Environmental Protection Agency (Ohio EPA) regulators; employees; and the Scotts Company throughout the duration of the project. The activities discussed in this plan are designed to meet these public communication needs and to satisfy regulatory requirements and guidelines. Appendix 10 C contains the Glossary of Terms.

This PIP summarizes past and present community concerns, outlines key objectives of the program, and presents an action plan for conducting public involvement activities in conjunction with the site investigation and remediation. The plan is divided into the following sections:

- An overview of the PIP (this section),
- A description and brief history of the facility;
- A profile of the Marysville community, its interest in and concerns about the site;
- A description of the public involvement objectives, activities, and timing; and
- Suggestions for future activities.

Appendix 10 A to this plan provides a mail list of interested parties and organizations, and Appendix 10 B lists locations for public meetings and the information repository.

This PIP will be reviewed and revised as needed based on any changes in public concerns or regulatory requirements in order to maintain effective dissemination of information.

#### **10.2 SITE HISTORY**

The Scotts Marysville facility is located about 1.5 miles southeast of Marysville, Ohio (Refer to Figure 2.1), at the intersection of Scottslawn Road and Industrial Parkway. The site is bounded by State Route (SR) 33 to the east, the Goodyear Plant to the south, Dennison Hydraulics to the north, and agricultural land to the west. The facility is bordered by property used for agricultural, residential, and industrial uses.

The Scotts Company formulates lawn and garden fertilizers at the Marysville facility. Construction of the facility began in 1955, and production started in 1957. Prior to 1955, the area was used for agricultural purposes. The Scotts Company facility consists of a main plant area, along with waste treatment and storage areas, research laboratories, product test fields, and unused land. The facility has four main process lines for the manufacture of its lawn and garden care products. Between 1956 and 1984, facility and process wastes were disposed of on site. The facility waste disposal areas included five landfills and two field broadcast areas (Plate 1).

Landfill No. 1 is located in the northwest portion of the property, just west of the railroad tracks and south of the stream. This landfill was utilized for waste disposal between 1956 and 1959. Landfill No. 2 is located in the east-southeast corner of the site, southwest of Industrial Parkway and southeast of
Scottslawn Road. A stream is located along the eastern and southern boundaries of the landfill. This landfill was utilized for waste disposal between 1959 and 1961. Landfill No. 3 is located in the northeast corner of the property, southeast of Scottslawn Road, and is bisected by SR 33. A portion of the landfill is present northeast of SR 33. Landfill No. 3 was used to dispose of waste between 1962 and 1964. Landfills No. 4 and 5 are located in the south-southeast corner of the site and are separated by a small stream. Another stream flows along the north side of each landfill. Waste disposal occurred at Landfill Nos. 4 and 5 from 1965 to 1976 and from 1976 to 1984, respectively. Field Broadcast Area No. 1 is located to the northwest of Landfill Nos. 4 and 5. Lawn products were spread between 1972 and 1973. Field Broadcast Area No. 2 is located to the northwest of Landfill No. 1 and was used for lawn product disposal between 1970 and 1971.

The lateral extent of waste disposal at each of the landfills is difficult to pinpoint because thick vegetation has grown in and around the landfills. At most of the landfills, there is no remaining surface expression marking the limit of waste placement. Aerial photographs taken between 1957 and 1994 were studied to locate landmarks that could be used to better define the limit of waste placement.

The O.M. Scott & Sons Co., now The Scotts Company, filed a U.S. EPA 103(c) Notification of Hazardous Waste Site Form on June 4, 1981. The 103(c) Notification stated that pesticides and fertilizers and some laboratory wastes were disposed on site. Much of the waste deposited in the landfills and field broadcast areas was off-spec vermiculite waste. The quantities of pesticides or herbicides contained in the vermiculite waste are unknown.

The Scotts Company initiated a voluntary hydrogeologic investigation in November 1996. Fourteen groundwater monitoring wells were installed and sampled. At this time Scotts also initiated a groundwater monitoring program utilizing fourteen new wells and also incorporating surface water and stream sediment sampling at three locations along Crosses Run. Six additional wells were added in 1997 to further evaluate groundwater conditions in two areas. To date, the only detections of pesticides in groundwater have been at low levels near the method detection limits. The groundwater monitoring conducted to date does not indicate that the waste units have had a major impact on groundwater.

# **10.3 COMMUNITY PROFILE AND CONCERNS**

The community is typically described as the region that is economically and culturally impacted by site operations. This includes the following counties: Union, Marion, Delaware, Franklin, Madison, Champaign, Logan, and Hardin. Based on the 1990 U.S. census, the total population of the eight-county area is approximately 1,271,117, with the population of the city of Marysville estimated at 9,656. Approximately 850 people are employed at the Scotts Marysville facility as plant personnel and in administrative positions. Employees commute from all surrounding counties, with the greater portion of workers residing in Union and Franklin counties.

# **10.4 PUBLIC INVOLVEMENT OBJECTIVES AND ACTIVITIES**

The public involvement objectives and activities were developed to encourage public participation during upcoming activities at the site. They are intended to ensure that residents and interested officials are informed about and offered an opportunity to provide input on the RFI and Corrective Measures Implementation (CMI) activities at the Scotts Marysville facility.

# 10.4.1 Public Involvement Objectives

The objectives of the public involvement activities for this site are to:

- Provide updates on site progress to employees; citizens; city, county, state, and local officials; and media;
- Educate the community about the RFI/CMI process;
- Provide opportunities and methods for concerned parties to voice comments and receive responses regarding environmental issues at the site; and
- Communicate with the media to enable them to provide accurate information to the public.

# **10.4.2** Public Involvement Activities

Two Ohio EPA staff members have been designated as contact persons for the project. The site coordinator, Chris Bulinski, CDO, Division of Hazardous Waste Management, oversees all site activities; and the public involvement coordinator, Tracy Freeman, coordinates the public involvement activities.

Various methods and techniques will be used to provide a forum for open communication during the RFI process, and they are discussed below. Proposed dates for the following activities are presented in Table 10.1.

# Public Information

Fact sheets written in nontechnical language will be produced as needed at particular milestones during the investigation process to provide the public with detailed information about the site activities. Stories or inserts may also be placed in the site's internal publication, *Green Scene*, to keep employees informed of the same accomplishments. The company's intranet system may also be used as a communication vehicle for employees.

An information repository containing documents and other information about the Scotts Marysville facility has been established at the Marysville Public Library in Marysville, Ohio. Appendix 10 B contains the information repository address, telephone number, and contact person's name. Prepared news releases will be disseminated to local newspapers, radio stations, and television stations to announce the occurrence of any public meetings and/or public comment periods, to report on project progress and/or completion, and to report the discovery of any significant findings at the site. News releases will be sent to the media listed in Appendix 10 A.

A legal notice and brief synopsis of any proposed corrective measures will be published in a major newspaper of general circulation.

# Public Participation

A 30-day public comment period will be held upon completion of the investigation when Ohio EPA has approved the selected corrective measures. The purpose of the public comment period is to enable all interested parties, including local officials, residents, groups, and Scotts, an opportunity to express their opinions about the selected corrective measures. The comment period will be determined by Ohio EPA and will be announced in a public notice advertisement published in the local newspaper and in a news release sent to local media.

Depending on the level of public interest expressed, a public meeting may be held during the public comment period to provide an open forum for citizens to present their questions and comments about the selected corrective measures. Public meetings may also be held at other stages throughout the process, if needed.

Public comments and questions can be directed to Ohio EPA's Division of Hazardous Waste Management or Public Interest Center at any time throughout this process.

The PIP will be revised and updated as necessary, based on the progress of the investigation. Updates may be needed to verify information, assess the PIP to date, and develop public involvement activities for the CMI phase, if any.

# Table 10.1

# Implementation Timeline for Public Involvement Activities\* Scotts Marysville Facility Union County, Ohio

| Activity                         | Start Date | Completion Date    |
|----------------------------------|------------|--------------------|
| Finalize and implement Public    | 06/15/99   | ongoing            |
| Involvement Plan                 |            |                    |
| Provide communication to         | 6/15/99    | ongoing, as needed |
| residents and officials          |            |                    |
| Establish contact person         | 06/01/99   | 06/15/99/          |
| Establish information repository | 06/15/99   | ongoing            |
| Draft and disseminate news       | 06/15/99   | ongoing, as needed |
| releases                         |            |                    |
| Prepare fact sheets              | 06/15/99   | ongoing            |
| Hold public meetings             | 6/8/99**   | ongoing, as needed |
| Provide public notices           | 6/9/99     | ongoing            |

\*Start dates are dependent on approval of the Scotts RFI Work Plan.

\*\*Actual date to be determined by Ohio EPA

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# **10.5 SUGGESTED FUTURE ACTIVITIES**

Upon completion of the site investigation and throughout the implementation of corrective measures, if required, it may be necessary to provide further information to the public. Should various groups express a heightened interest in environmental issues at the site, it may be beneficial to establish a list of key stakeholders, which may consist of a core group of employees, residents and public officials. Intermittent informational workshops may be held with this small group as an educational tool and to obtain additional input regarding decisions about the site. Such a group could also help establish and refine action plans to meet site-specific needs.

It would also be of benefit to the Scotts Company, as well as the community to provide environmental educational programs to area schools, such as sending volunteers to judge area science fairs and presenting science/environmental demonstrations in classrooms. In addition, some community or school groups may be interested in touring the facility in the future.

C **Appendix 10A** 

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# Appendix 10 A

# MAILING LIST

# **Federal Elected Officials**

Senator Mike DeWine 140 Russell Senate Office Building Washington, DC 20510 (202) 224-2315

Senator George Voinovich 140 Russell Senate Office Building Washington, DC 20510 (202) 224-3353

# **State Elected Officials**

Governor Bob Taft 77 South High Street 30<sup>th</sup> Floor Columbus, OH 43215 (614) 644-0957

Senator Larry Mumper, 26<sup>th</sup> District Senate Building Room #035 First Floor Columbus, OH 43215 (614) 466-8049

Representative Edward Core, 87<sup>th</sup> District 77 South High Street 11<sup>th</sup> Floor Columbus, OH 43266-0603 (614) 466-8147

### **City Officials**

Mayor John Taulbee 125 East Sixth Street Marysville, OH 43040 (937) 642-6015

# **County Officials**

James Mitchell, President Union County Commissioners 233 West Sixth Street Marysville, OH 43040 (937) 645-3012 Representative David Hobson 1514 Longworth House Office Building Washington, DC 20515 (202) 225-4324

Lt. Governor Maureen O'Conner 77 South High Street 30<sup>th</sup> Floor Columbus, OH 43215 (614) 644-0957

Thomas McCarthy Union County Commissioners 233 West Sixth Street Marysville, OH 43040 (937) 645-3012 Don Fraser Union County Commissioners 233 West Sixth Street Marysville, OH 43040 (937) 645-3012

# State Officials/Regulators

Chris Bulinski, Site Coordinator Ohio EPA Central District Office 3232 Alum Creek Drive Columbus, OH 43207-3417 (614) 728-3778

Tracy Freeman, Public Involvement Coordinator Ohio EPA Public Interest Center Lazarus Government Center P.O. Box1049 Columbus, OH 43216-1049 (614) 644-3020

### Interested Citizens (to be added as determined by public meetings)

### Media

### Newspapers

Marysville Journal Tribune Newsroom – Cindy Brake, Business Page Reporter 207 North Main Street Marysville, Ohio (937) 644-9111 e-mail: jtnews@marysvillejt.com

### Television

WCMH News 4 Attn: Kelly Frombach 3165 Olentangy River Road Columbus, OH 43202 (614) 263-5555

WBNS 10-TV Eyewitness News Attn: Assignment Desk 770 Twin Rivers Drive Columbus, OH 43215 (614) 460-3950 Columbus Dispatch Newsroom – Randy Edwards, Environmental or Business Editor 34 South Third Street Columbus, OH 43215 (614) 461-5200 fax: (614) 461-7580

WSYX-TV-Channel 6 Attn: Assignment Editor 1261 Dublin Road Columbus, OH 43215 (614)481-6666

Rebecca Roush, Clerk of Commission Union County Commissioners 233 West Sixth Street Marysville, OH 43040 (937) 645-3012

# Radio

WUCO Attn: Mike Ramsey, News Director 107 North Main Street Marysville, OH 43040 (937) 644-1160 WTVN 610 AM Radio Newsroom 1301 Dublin Road Columbus, OH 43215 (614) 487-2555

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Appendix 10B

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# Appendix 10 B

# PUBLIC MEETING LOCATIONS AND INFORMATION REPOSITORY

# **Public Meeting Facility**

(to be determined by Ohio EPA)

# **Information Repository**

Marysville Public Library Attn: Patricia Amis, Director 231 South Plum Street Marysville, OH 43040-1596 (937) 642-1876

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# Appendix 10 C

# **GLOSSARY OF TERMS**

CMI - see "Corrective Measures Implementation."

**Corrective Measures Implementation (CMI)** – The phase of the RCRA corrective action process in which the selected remedial measure is implemented.

**field broadcast area** – Areas of land used for the surface depositing of off-specification fertilizers and pest/weed control products at the Scotts facility.

groundwater – Water found beneath the earth's surface that fills pores between materials such as sand, soil, or gravel.

hydrogeologic – Relating to the hydraulic aspects of site geology.

off-spec - Off-specification.

RCRA - see "Resource Conservation and Recovery Act."

**RCRA Facility Investigation (RFI)** – The phase of the RCRA corrective action process in which an investigation is conducted in order to determine the nature and extent of any contamination.

**Resource Conservation and Recovery Act (RCRA)** – A federal law that established a regulatory system to track hazardous substances from generation until disposal. The law requires safe and secure procedures to be used in treating, transporting, sorting, and disposing of hazardous substances. RCRA is designed to prevent new hazardous waste sites.

RFI - see "RCRA Facility Investigation."

vermiculite waste – Unwanted or off-specification fertilizers and pest/weed control products that were contained in a silicate-based (vermiculite) carrier.

Section 11 SCHEDULE ) ."

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# SCHEDULE OF ACTIVITES

# **SECTION 11**

# **RCRA FACILITY INVESTIGATION WORK PLAN**

# FOR

# THE SCOTTS COMPANY 14111 Scottslawn Road Marysville, Ohio 43041

June 11, 1999

# 11.0 SCHEDULE OF ACTIVITIES

The proposed schedule for completing the RFI at the Scotts Marysville facility is shown in Figure 11.1. This schedule begins with the submittal of the Draft RFI Work Plan to Ohio EPA and concludes with Ohio EPA's approval of the Final RFI Report.



|             |                                               |          |             |                      |             |             |          |         |             | $\bigcirc$  |
|-------------|-----------------------------------------------|----------|-------------|----------------------|-------------|-------------|----------|---------|-------------|-------------|
| [           |                                               |          |             |                      | , 1999      | Qtr 3, 1999 | Qtr 4,   | 1999    | Qtr 1, 2000 | Qtr 2, 2000 |
| ID          | Task Name                                     | Duration | Start       | Finish               | May Jun     | Jul Aug S   | ep Oct N | lov Dec | Jan Feb Mar | Apr May Jun |
| 1           | FINAL RFI WORKPLAN                            | 92 days  | Fri 5/7/99  | Fri 8/6/99           |             |             |          |         |             |             |
| 2           | Preparation of Final RFI<br>Workplan          | 36 days  | Fri 5/7/99  | Fri 6/11/99          |             |             |          |         |             |             |
| 3           | Delivery of Final RFI<br>Workplan to Ohio EPA | 0 days   | Fri 6/11/99 | Fri 6/11/99          | • 6         | 5/11        |          |         |             |             |
| 4           | Ohio EPA Approval of Final<br>RFI Workplan*   | 57 days  | Fri 6/11/99 | Fri 8/6/99           |             |             |          |         |             |             |
| 5           | RFI IMPLEMENTATION                            | 96 days  | Fri 7/23/99 | Tue 10/26/99         |             |             |          |         |             |             |
| 6           | Mobilization                                  | 22 days  | Fri 7/23/99 | Fri 8/13/99          |             |             |          |         |             |             |
| 7           | Issue Subcontracts                            | 15 days  | Fri 7/23/99 | Fri 8/6/99           |             |             |          |         |             |             |
| 8           | Brushcutting                                  | 5 days   | Mon 8/9/99  | Fri 8/13/99          |             | . 0         |          |         |             |             |
| 9           | Soil, Surface Water, and<br>Sediment Sampling | 33 days  | Mon 8/9/99  | Fri 9/10/99          |             |             |          |         |             |             |
| 10          | Non-drill Sampling                            | 15 days  | Mon 8/9/99  | Mon 8/23/99          |             |             |          |         |             |             |
| 11          | Surface Water &<br>Sediment Sampling          | 8 days   | Mon 8/9/99  | Mon 8/16/99          |             |             |          |         |             |             |
| 12          | Background Hand<br>Augering                   | 5 days   | Mon 8/9/99  | Fri 8/13/99          |             | 0           |          |         |             |             |
| 13          | On-site Hand<br>Augering                      | 11 days  | Fri 8/13/99 | Mon 8/23/99          |             |             |          |         |             |             |
| 14          | Drilling Sampling                             | 26 days  | Mon 8/9/99  | Fri 9/3/99           |             |             |          |         |             |             |
| 15          | Direct Push (soil and groundwater             | 15 days  | Mon 8/9/99  | Mon 8/23/99          |             |             |          |         |             |             |
| 16          | Well Installation                             | 12 days  | Mon 8/16/99 | Fri 8/27/99          |             |             |          |         |             |             |
| 17          | Well Survey                                   | 5 days   | Mon 8/30/99 | Fri 9/3/99           |             |             |          |         |             |             |
|             |                                               |          |             |                      |             |             |          |         |             |             |
| * Estim     | ated Schedule Task                            |          | Milestone   | •<br>                | Summary     |             |          |         |             |             |
| Sou<br>RCRA | FACILITY INVESTIGATION SCHEDU                 | JLE      |             | Figure 1<br>PAGE 1 ( | 1.1<br>OF 2 |             |          |         | 5           | AE.         |

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|---------|---------------------------------------------|-----------------------------------------|--------------|----------------------|-------------|-------------|-------------|-------------|---------------------------------------|
|         |                                             |                                         |              |                      | , 1999      | Qtr 3, 1999 | Qtr 4, 1999 | Qtr 1, 2000 | Qtr 2, 2000                           |
| ID      | Task Name                                   | Duration                                | Start        | Finish               | May Jun     | Jul Aug Sep | Oct Nov Dec | Jan Feb Mar | Apr May Jun                           |
| 18      | Groundwater Sampling                        | 26 days                                 | Mon 8/16/99  | Fri 9/10/99          |             |             |             |             |                                       |
| 19      | Development                                 | 22 days                                 | Mon 8/16/99  | Mon 9/6/99           |             |             |             |             |                                       |
| 20      | Sampling                                    | 23 days                                 | Tue 8/17/99  | Wed 9/8/99           |             |             |             |             |                                       |
| 21      | Slug Test                                   | 11 days                                 | Tue 8/31/99  | Fri 9/10/99          |             |             |             |             |                                       |
| 22      | Demobilization                              | 5 days                                  | Mon 9/13/99  | Fri 9/17/99          |             | 0           |             |             |                                       |
| 23      | Data Analysis                               | 61 days                                 | Mon 8/9/99   | Fri 10/8/99          |             | [           |             |             |                                       |
| 24      | Data Validation                             | 44 days                                 | Mon 9/13/99  | Tue 10/26/99         |             |             | ]           |             |                                       |
| 25      | DRAFT RFI REPORT                            | 180 days                                | Wed 9/22/99  | Sun 3/19/00          |             |             |             |             |                                       |
| 26      | Preparation of Draft RFI<br>Report          | 90 days                                 | Wed 9/22/99  | Mon 12/20/99         |             |             |             |             |                                       |
| 27      | Delivery of Draft RFI Report<br>to Ohio EPA | 0 days                                  | Mon 12/20/99 | Mon 12/20/99         |             |             | •           | 12/20       |                                       |
| 28      | Ohio EPA Review of Draft<br>RFI Report      | 90 days                                 | Tue 12/21/99 | Sun 3/19/00          |             |             | C           |             |                                       |
| 29      | Delivery of Comments to<br>Scotts           | 0 days                                  | Sun 3/19/00  | Sun 3/19/00          |             |             |             | •           | 3/19                                  |
| 30      | FINAL RFI REPORT                            | 90 days                                 | Mon 3/20/00  | Sat 6/17/00          |             |             |             | <b>V</b>    |                                       |
| 31      | Preparation of Final RFI<br>Report          | 60 days                                 | Mon 3/20/00  | Thu 5/18/00          |             |             |             |             |                                       |
| 32      | Delivery of Final RFI Report<br>to Ohio EPA | 0 days                                  | Thu 5/18/00  | Thu 5/18/00          |             |             |             |             | <b>•</b> 5/18                         |
| 33      | Ohio EPA Approval of Final<br>RFI Report*   | 30 days                                 | Fri 5/19/00  | Sat 6/17/00          |             |             | ·           |             |                                       |
|         |                                             |                                         |              |                      |             |             |             |             |                                       |
| * Estim | ated Schedule Task                          |                                         | Milestone    | •                    | Summary     |             |             |             | · · · · · · · · · · · · · · · · · · · |
| Sa      |                                             | 11 E                                    |              | Figure 1<br>PAGE 2 0 | 1.1<br>DF 2 |             |             | 5           | AIC.                                  |
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PLATES

# APPENDIX C SECTION 11 PLATES: THESE DOCUMENTS ARE OVERSIZED AND UNABLE TO BE IMAGED. PLEASE SEE THE CONSENT ORDER BINDERS TO VIEW THE PLATES.

# **APPENDIX D**

# FACILITY SPECIFIC SCOPE OF WORK FOR A CORRECTIVE MEASURES IMPLEMENTATION THE SCOTTS COMPANY, MARYSVILLE, OHIO

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# SCOPE OF WORK FOR A CORRECTIVE MEASURES IMPLEMENTATION

# Introduction

The purpose of the Corrective Measures Implementation (CMI) portion of Ohio EPA's Corrective Action process is to design, construct, operate, maintain and monitor the performance of the corrective measure(s) proposed by the regulated entity and approved by Ohio EPA. Thus far in the Corrective Action Program (CAP), the CMI process generally entailed a conceptual design phase for the selected remedy, a detailed review of intermediate plans and specifications by the implementing agency, and the development of final plans and specifications.

The CAP encourages implementing agencies to make the process more flexible and streamlined. Intermediate design plans may or may not be required at specific design points (30, 50, 60, 90, and/or 95% are given as examples). Other sections may be combined or eliminated. Ohio EPA may consider other approaches to expedite the process and initiate implementation of corrective measure(s) more effectively.

As discussed in Chapter II of the federal RCRA Corrective Action Plan (OSWER Directive 9902.3-2A May 1994, Final), one such approach involves initiating Interim/stabalization measures (ISMs) prior to the CMI. Plans submitted for ISMs (e.g., health and safety plans, public involvement plans) may be used or updated during the CMI, particularly since ISMs should be compatible with final corrective measures. In most cases this will be true, with the only changes being an expansion/adjustment of the ISMs to constitute a final remedy.

Another approach to expedite the CMI process involves setting final remedial (or stabilization) media clean-up standards but not specifying the process by which the standards would be attained. This performance-based approach should lower oversight by Ohio EPA and promote faster, more effective cleanup.

# Purpose

The purpose of the Corrective Measures Implementation (CMI) program is to design, construct, operate, maintain and monitor the performance of the corrective measure or measures approved by the implementing agency. Corrective measures are intended to protect human health and/or the environment from releases from the facility. Scotts will furnish all personnel, materials and services necessary to implement the corrective measures program.

# Scope

The documents required for Corrective Measures Implementation are, unless Ohio EPA specifies otherwise, a Conceptual Design, Operation and Maintenance Plan, Intermediate Plans and Specifications, Final Plans and Specifications, Construction Workplan, Construction Completion Report, Corrective Measure Completion Report, Health and Safety Plan, Public Involvement Plan, and Progress Reports. The scope of work (SOW) for each document is specified below. The SOWs are intended to be flexible documents capable of addressing both simple and complex site situations. If Scotts can justify, to the satisfaction of Ohio EPA, that a plan and/or report or portions thereof are not needed in the given site-specific situation, then Ohio EPA may waive that requirement.

Ohio EPA may require Scotts to conduct additional studies beyond what is discussed in the SOWs in order to support the CMI program. Scotts will furnish all personnel, materials and services necessary to conduct the additional tasks to the extent needed to accomplish the objectives of the Consent Order.

# Task I: Conceptual Design (15% Design Point)

Scotts shall prepare a Conceptual Design (CD) that clearly describes the size, shape, form, and content of the proposed corrective measure; the key components or elements that are needed; the designer's vision of the corrective measure in the form of conceptual drawings and schematics; and the procedures and schedules for implementing the corrective measure(s). It should be noted that more than one conceptual design may be needed in situations where there is a complex site with multiple technologies being employed at different locations. Ohio EPA may require approval of the CD prior to implementation. The CD must, at a minimum, include the following elements:

- A. *Introduction/Purpose*: Describe the purpose of the document and provide a summary description of the project.
- **B. Corrective Measures Objectives:** Discuss the corrective measure objectives including applicable media cleanup standards.
- **C. Conceptual Model of Contaminant Migration**: Present a conceptual model of the site and contaminant migration. The conceptual model consists of a working hypothesis of how the contaminants may move from the release source to the receptor population. The conceptual model is developed by looking at the applicable physical parameters (e.g., water solubility, density, Henry's Law Constant, etc.) for each contaminant and assessing how the contaminant may migrate given the existing site conditions (geologic features, depth to groundwater, etc.). Describe the phase (water, soil, gas, non-aqueous) and location where contaminants are likely to be found. This analysis may have already been done as part of earlier work (e.g., Current Conditions Report). If this is the case, then provide a summary of the conceptual model with a reference to the earlier document.
- D. Description of Corrective Measures: Considering the conceptual model of contaminant migration, qualitatively describe what the corrective measure is supposed to do and how it will function at the facility. Discuss the feasibility of the corrective measure and its ability to meet the corrective measure objectives.
  - i. Data Sufficiency: Review existing data needed to support the design effort and establish whether or not there is sufficient accurate data available for this purpose. Scotts must summarize the assessment findings and specify any additional data needed to complete the corrective measure design. Ohio EPA may require or Scotts may propose that sampling and analysis plans and/or treatability study workplans be developed to obtain the additional data. Submittal times for any new sampling and analysis plans and/or treatability study workplans will be determined by Ohio EPA and will be included in the project schedule.
- E. **Project Management**: Describe the management approach including levels of authority and responsibility (include organization chart), lines of communication and the qualifications of key personnel who will direct the corrective measure design and the implementation effort (including contractor personnel).

- F. **Project Schedule**: The project schedule must specify all significant steps in the process and when all CMI deliverables (e.g., Operation and Maintenance Plan, Corrective Measure Construction Workplan, etc.) are to be submitted to Ohio EPA.
- **G. Design Criteria**: Specify performance requirements for the overall corrective measure and for each major component. Scotts must select equipment that meets the performance requirements.
- **H. Design Basis:** Discuss the process and methods for designing all major components of the corrective measure. Discuss the significant assumptions made and possible sources of error. Provide justification for the assumptions.
  - i. Conceptual Process/Schematic Diagrams.
  - ii. Site plan showing preliminary plant layout and/or treatment area.
  - iii. Tables listing number and type of major components with approximate dimensions.
  - iv. Tables giving preliminary mass balances.
  - v. Site safety and security provisions (e.g., fences, fire control, etc.).

- I. Waste Management Practices: Describe the wastes generated by the construction of the corrective measure and how they will be managed. Also discuss drainage and indicate how rainwater run-off will be managed.
- J. **Required Permits**: List and describe the permits needed to construct and operate the corrective measure. Indicate on the project schedule when the permit applications will be submitted to the applicable agencies and an estimate of the permit issuance date.
- K. Long-Lead Procurement Considerations: Scotts shall prepare a list of any elements or components of the corrective measure that will require custom fabrication or for some other reason why the items are considered long-lead items, the length of time necessary for procurement, and the recognized sources of such procurement.

# L. Appendices including:

- i. Design Data tabulations of significant data used in the design effort;
- ii. Equations list and describe the source of major equations used in the design process;
- iii. Sample Calculations Present and explain one example calculation for significant or unique design calculations; and
- iv. Laboratory or Field Test Results.

# Task II: Operation and Maintenance Plan

Scotts shall prepare an Operation and Maintenance (O&M) Plan that outlines procedures for performing operations, long-term maintenance, and monitoring of the corrective measure. A draft O&M Plan shall be submitted to the implementing agency simultaneously with the draft Plans and Specifications (see III). A final O&M Plan shall be submitted to the implementing agency simultaneously with the final Plans and Specifications. The O&M Plan shall, at a minimum, including the following elements:

- A. *Introduction/Purpose*: Describe the purpose of the document and provide a summary description of the project.
- **B.** *Project Management*: Describe the management approach including levels of authority and responsibility (include organization chart), lines of communication and the qualifications of key personnel who will operate and maintain the corrective measures (including contractor personnel).
- **C.** System Description: Describe the corrective measure and identify significant equipment.
- **D.** *Personnel Training*: Describe the training process for O&M personnel. Scotts shall prepare, and include in the technical specifications governing treatment systems, the contractor requirements for providing: appropriate service visits by experienced personnel to supervise the installation, adjustment, start-up and

operation of the treatment systems, and training covering appropriate operational procedures once the start-up has been successfully accomplished.

- E. Start-up Procedures: Describe system start-up procedures including any operational testing.
- F. **O&M Procedures**: Describe normal operation and maintenance procedures including:
  - i. Description of tasks for operation;
  - ii. Description of tasks for maintenance;
  - iii. Description of prescribed treatment or operation conditions, and
  - iv. Schedule showing frequency of each O&M task.

- G. Replacement schedule for equipment and installed components.
- H. Waste Management Practices: Describe the wastes generated by operation of the corrective measure and how they will be managed. Also discuss drainage and indicate how rainwater run-off will be managed.
- I. Sampling and Analysis: Sampling and monitoring activities may be needed for effective operation and maintenance of the corrective measure. To ensure that all information, data and resulting decisions are technically sound, statistically valid, and properly documented, Scotts shall prepare a Quality Assurance Project Plan (QAPP) to document all monitoring procedures, sampling, field measurements and sample analyses performed during these activities. Scotts shall use quality assurance, quality control, and chain-of-custody procedures approved by Ohio EPA.
- J. Corrective Measure Completion Criteria: Describe the process and criteria (e.g., groundwater cleanup goal met all compliance points for one year) for determining when corrective measures have achieved media cleanup goals. Also describe the process and criteria for determining when maintenance and monitoring may cease. Criteria for corrective measures such as a landfill cap must reflect the need for long-term monitoring and maintenance. Satisfaction of the completion criteria will trigger preparation and submittal of the Corrective Measures Completion Report.

# K. O&M Contingency Procedures:

- i. Procedures to address system breakdowns and operational problems including a list of redundant and emergency back-up equipment and procedures;
- ii. Alternate procedures to be implemented if the corrective measure suffers complete failure. The alternate procedures must be able to prevent release or threatened releases of hazardous wastes or constituents which may endanger human health and/or the environment or exceed media cleanup standards;
- iii. The O&M Plan must specify that, in the event of a major breakdown and/or complete failure of the corrective measures (includes emergency situations), Scotts will orally notify the implementing agency within 24 hours of the event and will notify the implementing agency within 72 hours of the event. Written notification must, at a minimum, specify what happened, what response action is being taken and/or is planned, and any potential impacts on human health and/or the environment; and
- iv. Procedures to be implemented in the event that the corrective measure is experiencing major operational problems, is not performing to design specifications and/or will not achieve the cleanup goals in the expected time frame. For example, in certain

circumstances both a primary and secondary corrective measure may be selected for the Facility. If the primary corrective measure were to fail, then the secondary would be implemented. This section would thus specify that if the primary corrective measure failed, then design plans would be developed for the secondary measure.

- L. **Data Management and Documentation Requirements**: The O&M Plan shall specify that Scotts collect and maintain the following information:
  - i. Progress report information;
  - ii. Monitoring and laboratory data;
  - iii. Records of operating costs; and
  - iv. Personnel, maintenance and inspection records.

This data and information should be used to prepare progress reports and the Corrective Measure Completion Report.

# Task III: Intermediate Plans and Specifications (30, 50, 60, 90 and/or 95% Design Point)

[Note: Scotts may propose or Ohio EPA may require the submittal of several intermediate plans and specifications (e.g., at the 60% Design Point) or none at all.]

Scotts shall prepare draft Plans and Specifications that are based on the Conceptual Design but include additional design detail. A draft O&M Plan and Construction Workplan shall be submitted to Ohio EPA simultaneously with the draft Plans and Specifications. The draft design package must include drawings and specifications needed to construct the corrective measure. Depending on the nature of the corrective measure, many different types of drawings and specifications may be needed. Some of the elements that may be required are:

- a. General Site Plans.
- b. Process Flow Diagrams
- c. Mechanical Drawings
- d. Electrical Drawings
- e. Structural Drawings
- f. Piping and Instrumentation Diagrams
- g. Excavation and Earthwood Drawings
- h. Equipment Lists
- i. Site Preparation and Field Work Standards
- j. Preliminary Specifications for Equipment and Material

General correlation between drawings and technical specifications is a basic requirement of any set of working construction plans and specifications. Before submitting the project specifications to Ohio EPA, Scotts shall:

a. Proofread the specifications for accuracy and consistency with the conceptual design; and

b. Coordinate and cross-check the specifications and drawings.

# Task IV: Final Plans and Specifications (100% Design Point)

Scotts shall prepare Final Plans and Specifications that are sufficient to be included in a contract document and be advertised for bid. A final O&M Plan and Construction Workplan shall be submitted to the implementing agency simultaneously with the final Plans and Specifications. The final design package must consist of the detailed drawings and specifications needed to construct the corrective measure. Depending on the nature of the corrective measure, many different types of drawings and specifications may be needed. Some of the elements that may be required are:

- a. General Site Plans.
- b. Process Flow Diagrams
- c. Mechanical Drawings
- d. Electrical Drawings
- e. Structural Drawings
- f. Piping and Instrumentation Diagrams
- g. Excavation and Earthwood Drawings
- h. Equipment Lists
- i. Site Preparation and Field Work Standards
- j. Construction Drawings
- k. Installation Drawings
- I. Detailed Specifications for Equipment and Material

# Task V: Construction Workplan

Scotts shall prepare a Construction Workplan which documents the overall management strategy, construction quality assurance procedures and schedule for constructing the corrective measure. A draft Construction Workplan shall be submitted to Ohio EPA simultaneously with the draft Plans and Specifications and draft O&M Plan. A final Construction Workplan shall be submitted to Ohio EPA simultaneously with the final Plans and final O&M Plan. Upon receipt of written approval from the implementing agency, Scotts shall commence the construction process and implement the Construction Workplan in accordance with the schedule and provisions contained therein. The Construction Workplan must be approved by Ohio EPA prior to the start of corrective measure construction. The Construction Workplan must, at a minimum, include the following elements:

- A. *Introduction/Purpose*: Describe the purpose of the document and provide a summary description of the project.
- B. **Project Management**: Describe the construction management approach including levels of authority and responsibility (include organization chart), lines of communication and the qualifications of key personnel who will direct the corrective measure construction effort and provide construction quality assurance/quality control (including contractor personnel).
- C. **Project Schedule**: The project schedule must include timing for key elements of the bidding process, timing for initiation and completion of all major corrective measure construction tasks as specified in the Final

Plans and Specifications, and specify when the Construction Completion Report is to be submitted to Ohio EPA.

- D. Construction Quality Assurance/Quality Control Programs: The purpose of construction quality assurance is to ensure, with a reasonable degree of certainty, that a completed corrective measure will meet or exceed all design criteria, plans, and specifications. The Construction Workplan must include a complete Construction Quality Assurance Program to be implemented by Scotts.
- E. *Waste Management Procedures*: Describe the wastes generated by construction of the corrective measure and how they will be managed.
- F. Sampling and Analysis: Sampling and monitoring activities may be needed for construction quality assurance/quality control and/or other construction related purposes. To ensure that all information, data and resulting decisions are technically sound, statistically valid, and properly documented, Scotts shall prepare a QAPP to document all monitoring procedures, sampling, field measurements and sample analysis performed during these activities. Scotts shall use quality assurance, quality control, and chain-of-custody procedures approved by Ohio EPA.

# G. Construction Contingency Procedures:

- 1. Changes to the design and/or specifications may be needed during construction to address unforeseen problems encountered in the field. Procedures to address such circumstances, including notification of the implementing agency, must be included in the Construction Workplan;
- 2. The Construction Workplan must specify that, in the event of a construction emergency (e.g., fire, earthwork failure, etc.) Scotts will orally notify Ohio EPA within 24 hours of the event and will notify Ohio EPA in writing within 72 hours of the event. The written notification must, at a minimum, specify what happened, what response action is being taken and/or is planned, and any potential impacts on human health and/or the environment; and
- 3. Procedures to be implemented if unforeseen events prevent corrective measure construction. For example, in certain circumstances both a primary and secondary corrective measure may be selected for the Facility. If the primary corrective measure could not be constructed, then the secondary would be implemented. This section would thus specify that if the primary corrective measure could not be constructed, then design plans would be developed for the secondary measure.
- H. Construction Safety Procedures: Construction safety procedures should be specified in a separate Health and Safety Plan.
- I. Documentation Requirements:
Scotts shall describe how analytical data and results will be evaluated, documented, and managed.

#### J. Cost Estimate/Financial Assurance:

Financial assurance for corrective measure construction and operation may be required by an enforcement order. The Construction Workplan must include a cost estimate and specify which financial mechanism will be used and when the mechanism will be established. The cost estimate shall include both construction and operation and maintenance costs. An initial cost estimate shall be included in the draft Construction Workplan and a final cost estimate shall be included in the final Construction Workplan. The financial assurance mechanism may include a Performance or Surety Bond, a Trust Fund, a Letter of Credit, Financial Test and Corporate Guarantee equivalent to that in 40 CFR '265.13 or any other mechanism acceptable to Ohio EPA.

Financial assurance mechanisms are used to assure Ohio EPA that Scotts has adequate financial resources to construct and operate the corrective measure.

#### Task VI: Construction Completion Report

Scotts shall prepare a Construction Completion (CC) Report which documents how the completed project is consistent with the Final Plans and Specifications. A CC Report shall be submitted to Ohio EPA when the construction and any operational tests have been completed. The CC Report shall, at a minimum, include the following elements:

- 1. Purpose;
- 2. Synopsis of the corrective measure, design criteria, and certification that the corrective measure was constructed in accordance with the Final Plans and Specifications;
- 3. Explanation and description of any modifications to the Final Plans and Specifications and why these were necessary for the project;
- 4. Results of any operational testing and/or monitoring, indicating how initial operation of the corrective measure compares to the design criteria;
- 5. Summary of significant activities that occurred during construction. Include a discussion of problems encountered and how they were addressed;
- 6. Summary of any inspection findings (include copies of key inspection documents in appendices);
- 7. As built drawings of photographs; and

8. Schedule indicating when any treatment systems will begin full scale operations.

## Task VII: Corrective Measure Completion Report

Scotts shall prepare a Corrective Measure Completion (CMC) Report when Scotts believes that the corrective measure completion criteria have been satisfied. The purpose of the CMC Report is to fully document how the corrective measure completion criteria have been satisfied and to justify why the corrective measure and/or monitoring may cease. The CMC Report shall, at a minimum, include the following elements:

- 1. Purpose;
- 2. Synopsis of the corrective measure;
- 3. CMC Criteria: Describe the process and criteria for determining when corrective measures, maintenance and monitoring may cease. CMC criteria were given in the final O&M Plan;
- 4. Demonstration that the completion criteria have been met. Include results of testing and/or monitoring, indicating how operation of the corrective measure compares to the completion criteria;
- 5. Summary of work accomplishments (e.g., performance levels achieved, total hours of treatment operation, total treated and/or excavated volumes, nature and volume of wastes generated, etc.);
- 6. Summary of significant activities that occurred during operations. Include a discussion of problems encountered and how they were addressed;
- 7. Summary of inspection findings (include copies of key inspection documents in appendices); and
- 8. Summary of total O&M costs.

#### Task VIII: Health and Safety Plan

Scotts shall submit a Health and Safety Plan for all field activity, although it does not require review and approval by Ohio EPA. The Health and Safety Plan shall be developed as a stand alone document but may be submitted with the CMI Workplan. The Health and Safety Plan must, at a minimum, include the following elements:

1. **Objectives:** Describe the goals and objectives of the health and safety program (must apply to on-site personnel and visitors). The Health and Safety Plan must be consistent with the Facility Contingency Plan, OSHA Regulations, NIOSH Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (1985), all state and local regulations and other Ohio EPA guidance as provided.

- 2. *Hazard Assessment*: List and describe the potentially hazardous substances that could be encountered by field personnel during construction and/or O&M activities. Discuss the following:
  - 1. Inhalation Hazards
  - 2. Dermal Exposure
  - 3. Ingestion Hazards
  - 4. Physical Hazards
  - 5. Overall Hazard Rating

Include a table that, at a minimum lists: known contaminants, highest observed concentration, media, symptoms/effects of acute exposure.

#### 3. Personal Protection/Monitoring Equipment

- 1. Describe personal protection levels and identify all monitoring equipment for each operational task.
- 2. Describe any action levels and corresponding response actions (i.e., when will levels of safety be upgraded).
- 3. Describe decontamination procedures and areas.

#### 4. Site Organization and Emergency Contacts

List and Identify all contacts (include phone numbers). Identify the nearest hospital and provide a regional map showing the shortest route from the facility to the hospital. Describe site emergency procedures and any site safety organizations. Include evacuation procedures for neighbors (where applicable).

#### Task IX: Public Involvement Plan

All Public Involvement Plans (PIP) prepared by Scotts shall be submitted to Ohio EPA approval prior to use. Permittees/ Respondents must never appear to represent or speak for Ohio EPA before the public, other government officials, or media.

Public Involvement activities that may be required for Scotts include the following:

- 1. Conducting an open house or informal meeting (i.e., availability session) in a public location where people can talk to Ohio EPA officials and Scotts on a one-to-one basis;
- 2. Preparing fact sheets summarizing current or proposed corrective action activities (all fact sheets should be reviewed by Ohio EPA prior to public distribution);
- 3. Communicating effectively with people who have vested interest in the corrective action activities (e.g., providing written or verbal information in

the foreign language of a predominantly non-English speaking community); and

4. Maintaining an easily accessible repository (such as a town hall or public library or the facility itself, in some limited circumstances) of information on the facility-specific corrective action program, including the order or permit, approved workplans, and/or other reports.

A schedule for community relations activities shall be included in the PIP.

## Section X: Progress Reports

Scotts will, at a minimum, provide Ohio EPA with signed bimonthly progress reports during corrective measure design, construction, operation and maintenance. Ohio EPA may adjust the frequency of progress reporting to address site-specific needs. For example, more frequent progress reports may be needed to track critical activities such as corrective measure construction and start-up. Progress reports must, at a minimum, include the following elements:

- 1. A description of significant activities (e.g., sampling events, inspections, etc.) and work completed/work accomplishments (e.g., performance levels achieved, hours of treatment operation, treated and/or excavated volumes, concentration of contaminants in treated and/or excavated volumes, nature and volume of wastes generated, etc.) during the reporting period;
- 2. Summary of system effectiveness. Provide a comparison of system operation to predicted performance levels (applicable only during operation of the corrective measure);
- 3. Summaries of all findings (including any inspection results);
- 4. Summaries of all contacts with representatives of the local community, public interest groups or State government during the reporting period;
- 5. Summaries of all problems or potential problems encountered during the reporting period;
- 6. Actions being taken and/or planned to rectify problems;
- 7. Changes in personnel during the reporting period;
- 8. Projected work for the next reporting period; and
- 9. Results of any sampling tests and/or other data generated during the reporting period.

# Section XI: Proposed Schedule

Scotts will provide Ohio EPA with the following schedule for each unit in accordance with the requirements contained in Section IX(A)(3) of the Consent Order:

| Facility Submission                       | Due Date                                                                                                                                                           |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Conceptual Design (I)                     | [DATE]                                                                                                                                                             |
| Operation & Maintenance Plan (II)         | [DATE]                                                                                                                                                             |
| Intermediate Plans & Specifications (III) | [NUMBER] days after Conceptual Design<br>Approval                                                                                                                  |
| Final Plans & Specifications (IV)         | [NUMBER] days after Ohio EPA comments<br>on Intermediate Plans & Specifications (date<br>of approval may be tied to submittal of the<br>CMI Workplan, if required) |
| Construction Workplan (V)                 | Concurrent with Final Plans & Specifications (or approval thereof)                                                                                                 |

| Construction Completion (VI)               | [DATE]                                                                         |
|--------------------------------------------|--------------------------------------------------------------------------------|
| Corrective Measure Completion Report (VII) | [DATE] (based on when completion criteria are believed to have been satisfied) |
| Health & Safety Plan (VIII)                | [DATE]                                                                         |
| Public Involvement Plan (IX)               | [DATE]                                                                         |
| Progress Reports on (I-IX)                 | Bimonthly                                                                      |

# APPENDIX E POND 3 CLOSURE

The Permit To Install Application shall provide for the closure of Pond 3 consistent with fully meeting/implementing the requirements set forth below:

- 1. Scotts shall land apply wastewater at a rate that does not exceed the nitrogen requirements of the crop to be grown on the application site (200 - 250 lb/acre grassland).
- 2. The following isolation distances shall be maintained during land application:
  - Wells, public or private - 300 feet
  - Neighbor occupied building - 300 feet • - 100 feet
  - Ponds, ditches, streams
- 3. Nutrient waters shall not be land applied under any of the following conditions:
  - More than 0.5 inches of rainfall has occurred in the preceding 12 hours or can be reasonably expected to occur during the day.
  - More than 1.0 inch of snow cover or frozen ground.
  - Under any circumstances or weather conditions that will lead to • runoff of the applied nutrient water.
- 4. Wastewaters generated through or in association with the Recycle I process wastewater treatment system shall not be land applied or disposed of in any of the recycle ponds.
- 5. Scotts shall maintain a record of the nutrient water management program. Records shall be kept for each application as noted below and made immediately available to Ohio EPA upon request:
  - Application site location.
  - Amount of land utilized for land application. •
  - Date(s) of application
  - Crop to be grown ٠
  - Any problems, permit deviations (include explanation) or general • comments.
- 6. Appropriate erosion and sediment controls shall be installed prior to any construction at Pond 3. They shall be maintained until vegetation is established sufficient to control erosion.

- 7. Prior to construction, solidification tests shall be performed to determine the unconfined compressive strength of various mixtures of vermiculite waste and cement kiln dust (CKD) or other suitable material as approved by the Director of Ohio EPA. These tests shall be performed to determine the ratio of CKD and vermiculite waste that provides sufficient strength for compaction and suitable dewatering of the waste. The source of the cement kiln dust utilized in these tests shall be the same source selected by the contractor. The results of the solidification tests shall be submitted to and reviewed for acceptance by the Ohio EPA, Central District Office prior to construction.
- 8. Waste shall be moved back from the stream, a minimum distance of 10 feet, such that equipment can compact the soil into what will be referred to as the barrier wall between the waste and the stream.
- 9. Soil used to construct the cap and the barrier wall shall have the following particle size distribution:
  - 100 % of the material must pass a 10" screen with 98% of the material passing a 6" screen.

95% of the material must pass a 3" screen.

70% of the material must pass the #10 sieve.

10. Soils used to construct the cap and the barrier wall shall be tested for the following parameters at intervals of every 3000 cubic yards of soil used:

For particle size gradation using sieve and hydrometer testing (ASTM D-422)

For moisture/density relationship using either the Standard Proctor (ASTM-D-698) or Modified Proctor (ASTM D-1557) methods.

- 11. Soil used, for both the barrier wall and the cap, shall have an in-situ permeability of no greater than 1x10-5 centimeters per second or laboratory determined permeability of no greater than 1x10-6 when compacted to 95% of the maximum Standard Proctor Density or 90% of the maximum Modified Proctor Density. Results of the tests, on the soils to be used for construction, shall be submitted to Ohio EPA Central District Office at least 15 days prior to construction.
- 12. The barrier wall and cap shall be installed in loose lifts not to exceed 8 inches in thickness to facilitate uniform compaction. The lifts shall be compacted to at least 95% of the maximum Standard Proctor Density or

at least 90% of the maximum Modified Proctor Density and, at a minimum, have in-situ permeability of no greater than  $1 \times 10-5$  centimeters per second or a laboratory determined permeability of  $1 \times 10-6$  centimeters per second.

- 13. During construction of the cap and the barrier wall, compaction must be monitored to ensure that the proper specifications are met. The following methods may be used, nuclear method (ASTM D-2922), sand cone (ASTM D-1556), or rubber balloon (ASTM D-2167). The nuclear method, if used, should be performed at least five times per acre per lift. The sand cone or rubber balloon methods should be performed at least three times per acre per lift. The sampling rate for any other methods that might be used will be determined on an individual basis.
- 14. Upon completion of construction, the permeability of the cap and barrier wall must be determined. This can be accomplished through either field permeability testing (Boutwell two-stage permeameter, SDRI), a construction test pad or through laboratory testing of cap samples brought to the lab for analysis (Shelby tubes, soil blocks). The permeability requirements for each type of permeability determination are as follows:

-For field permeability tests (Boutwell, SDRI), the required permeability of the cap is  $1 \times 10-5$  cm/sec.

-For laboratory permeability test (Shelby tubes, soil blocks), the required permeability of the cap is  $1 \times 10-6$ . One permeability test shall be performed for every 10,000 cubic yards of clay fill with a minimum of 2 samples.

Any penetrations into the cap layer resulting from either compaction or permeability testing should be repaired using bentonite or a bentonite/soil mixture.

- 15. The cap shall be at least 2 feet thick and maintain a minimum slope of 4% to ensure runoff during rain events.
- 16. The cap shall be seeded with grasses or similar vegetation as many times as needed to establish a dense vegetative cover.
- 17. The testing results, both during and after construction, should be submitted to Ohio EPA, Central District Office, along with the as built drawings of the pond closure, within 60 days of completion of construction. At a minimum, the as built drawings shall include a survey of the following:

- the bottom elevation of the pond
- bottom elevation of the cap
- top elevation of compacted cap
- full delineation of the barrier wall and waste limits
- 18. The cap shall be maintained such that no ponding of water occurs and a good stand of vegetation is sustained.
- 19. Mowing of the cap should occur at a frequency that prevents the establishment of trees and shrubs.
- 20. Post-closure shall continue for 15 years.

(A) Any time during the post-closure period, the director may:
(1) Shorten the post-closure care period if a request has been made and the director finds that the reduced period is sufficient to protect human health and the environment, based on such factors as the inspections and monitoring results conducted in accordance with the PTI; or
(2) Extend the post-closure care period, if the director finds that the extended period is necessary to protect human health and the environment, based on such factors as the monitoring results required by the PTI.

(B) Post-closure care activities shall include, but are not limited to:(1) Continuing operation and maintenance the surface water management

system, and the ground water monitoring system; and

(2) Maintaining the integrity and effectiveness of the cap system, including making repairs to the cap system as necessary to correct the effects of settling, dead vegetation, subsidence, erosion, or other events, and preventing run-on and runoff from eroding or otherwise damaging the cap system; and

(3) Semi-annual inspections of the landfill facility during each year of the post-closure care period and submittal of a written summary to the appropriate Ohio EPA district office not later than fifteen days after the inspection date detailing the results of the inspection and a schedule of any actions to be taken to maintain compliance with the PTI. The director may either increase the frequency of inspections, or, upon the request of the permittee, decrease the frequency of inspections if the results of past inspections justify either action; and

(4) Fulfilling all monitoring and reporting requirements in accordance with the PTI.

21. Scotts shall develop a post closure groundwater monitoring plan, within 6 months from the date of entry of the Consent Order or within 6 months following the closure of Pond 3 (whichever date comes first), to assess the potential groundwater impacts resulting from the Pond 3 closure. The monitoring plan developed to assess Pond 3 may be included in the

comprehensive/site wide groundwater monitoring plan being developed to address previously closed units and those units that will be closed through the RCRA Corrective Actions process. The plan shall provide for implementation of ground water monitoring within 3 months following review and acceptance by the Ohio EPA.

22. If the ground water or surface water is found to be impacted by the waste in Pond 3, then corrective actions may be required to mitigate the contamination.

# Vorys, Sater, Seymour and Pease LLP

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July 18, 2005

### VIA REGISTERED MAIL

Ohio EPA, Central District Office Attn: DSW Enforcement Group Leader 3232 Alum Creek Drive Columbus, Ohio 43207

Ohio EPA Lazarus Government Center Division of Hazardous Waste Management Attn: Manager, Compliance Assurance Section P.O. Box 1049 Columbus, Ohio 43216-1049 Ohio EPA, Central District Office Attn: RCRA Group Leader 3232 Alum Creek Drive Columbus, Ohio 4320

Ohio EPA Lazarus Government Center Division of Surface Water Attn: Enforcement Coordinator P.O. Box 1049 Columbus, Ohio 43216-1049

Dale E. Vitale Esq. Ohio Attorney General's Office Environmental Enforcement Section State Office Tower 30 East Broad Street 25th Floor Columbus, OH 43215

Re: The Scotts Company, Consent Order and Final Judgment, Entered January 25, 2002, Union County Common Pleas Court, Case No. 01-CV-0277

To whom it may concern:

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On January 25, 2002, The Scotts Company entered a Consent Order and Final Settlement in a case styled State of Ohio, ex rel. Betty D. Montgomery v. The Scotts Company, Case No. 01-CV-0277, Union County Common Pleas Court ("Order").

We are writing to notify you that The Scotts Company was merged into The Scotts Company LLC, its wholly owned subsidiary, as part of a corporate restructuring. This July 18, 2005 Page 2

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restructuring is described more fully in the Proxy Statement, which I have included for your convenience.

If you have any questions, please feel free to call.

Sincerely yours,

Mistin Watt

Kristin L. Watt

KLW/slb

Enclosure

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