EDM

IN THE COURT OF COMMON PLEAS
VINTON COUNTY, OHIO

STATE OF OHIO, EX REL., ANTHONY J. CELEBREZZE, JR., ATTORNEY GENERAL OF OHIO,	:	CASE NO. 88-CV6-46
	:	JUDGE MICHAEL BRAME
Plaintiff,	:	
v.	:	
CSX TRANSPORTATION, INC.,	:	
Defendant.	:	

FILED
1990 APR 20 AM 10:35
VINTON COUNTY
CLERK OF COURTS

CONSENT ORDER

WHEREAS, the State of Ohio ("Plaintiff"), on the relation of its Attorney General, Anthony J. Celebrezze, Jr., filed a Complaint against CSX Transportation, Inc. ("CSXT" or "Defendant"), seeking, inter alia, injunctive relief, reimbursement of past response costs, civil penalties, and a tax, for alleged violations of Ohio Revised Code Chapters 3734, 3767, and 6111, relating to this matter which arises from a spill of methylene chloride on or about November 19, 1984, near Raccoon Creek and State Route 278 in Zaleski, Vinton County, Ohio (hereinafter "this matter") (the spill area near Racoon Creek and State Route 278 in the vicinity of Zaleski in Vinton County, Ohio is hereinafter referred to as "the site"); and

WHEREAS, Defendant CSXT has filed an answer denying any and all liability as alleged by Plaintiff; and

WHEREAS, the parties now desire to settle and compromise all claims of the State of Ohio with respect to this matter, to wit: reimbursement of costs incurred by the Ohio Environmental Protection Agency or the Ohio Attorney General through April 30, 1990 with respect to this matter, any claim for civil penalties which the State has made or could have made with respect to this matter, and any tax which the State of Ohio alleges in its Complaint is owed by CSXT with respect to this matter (collectively, "monetary claims"), as well as all claims for injunctive relief with respect to this matter; and

WHEREAS, the State of Ohio reserves its right to make claims for response costs, if any, incurred by it after April 30, 1990; and

WHEREAS, Defendant CSXT reserves all its rights, claims and defenses with respect to any future claims for response costs incurred after that date which might be made by the State of Ohio; and

WHEREAS, this settlement is entered into between the parties without trial or disposition by the Court of any issue of law or of fact, without any admission of liability by Defendant, and without waiver of any defenses available to the Defendant, and upon the consent of the parties hereto; and

WHEREAS, the parties agree that this settlement may not be utilized in evidence by any person or party in this or any other matter, other than in an action to enforce this Consent Order, and that this settlement is not intended to create any right in any person not a party hereto;

THEREFORE, it is hereby ORDERED, ADJUDGED and DECREED as follows:

I.

A. For the purposes of this settlement in this Order and for no other purpose, the parties agree that the Court has jurisdiction over the subject matter of this Consent Order, the parties hereto, and that venue is proper in this Court. CSXT expressly reserves its right to contest the jurisdiction of this Court with respect to any matter not made the basis of this Consent Order.

B. 1. Terms of the Order and Persons to Whom Consent Order Applicable. All provisions of this Consent Order shall apply to and be binding upon the parties to this action, their assigns and successors in interest, the parties' officers, directors, agents, servants, employees, and consultants. CSXT shall provide copies of this Order to all general contractors or consultants performing any work called for by this Order.

2. Continuing Jurisdiction. This Court shall retain jurisdiction of this action to oversee the implementation of this Consent Order.

3. Right of Entry. During the effective time of this Consent Order, the State of Ohio and its agents and employees shall have authority to enter, without a search warrant, at any reasonable time, onto the Zaleski site to inspect, to take appropriate samples and/or to observe work conducted by CSXT or its contractor as required by this Consent Order. This provision in no way limits the State's statutory authority to conduct inspections and/or to take appropriate samples. The State agrees to split samples with CSXT.

II.

In settlement, compromise and final satisfaction of all monetary claims, as that term is defined herein, made by the State of Ohio in this matter, within ten (10) days of the entry of this Consent Order, Defendant CSXT shall remit three checks in the total amount of $90,000.00 in full settlement and compromise and satisfaction of the monetary claims in this matter made by the State of Ohio against Defendant CSXT. One check of $40,000.00 shall be considered as a full settlement, compromise and satisfaction of the State's claims for civil penalties and shall be credited to the State Treasury Hazardous Waste Cleanup Fund; one check for $10,000.00 shall be credited to the State Treasury General Revenue Fund; and one check for $40,000.00 shall

be credited to the State Treasury Immediate Removal Fund. The checks shall be forwarded to Paul D. Hancock at his office at the Attorney General's Office, Environmental Enforcement Section, 30 East Broad Street, 25th Floor, Columbus, Ohio 43266-0410. A copy of the transmittal letter shall be forwarded to Ohio EPA, P.O. Box 1049, Columbus, Ohio 43266-0410, Attn: Pat Campbell, DERR.

III.

In settlement, compromise and final satisfaction of all claims for injunctive relief made by the State of Ohio in this matter with respect to the release of methylene chloride as a result of the derailment of a CSXT train on November 19, 1984, and except as provided for in Section III.F., Defendant CSXT shall undertake the following:

A. Soil Vapor Extraction. By April 30, 1990, CSXT shall submit to Ohio EPA a design plan for a preliminary field system utilizing soil vapor extraction for removal of methylene chloride from unsaturated soils. Ohio EPA is committed to expeditiously review and provide comments to CSXT on the plan. Ohio EPA anticipates that it will comment and will endeavor to comment within five (5) business days after its receipt. If changes are suggested, CSXT either shall adopt those changes and receive Ohio EPA approval of the plan or shall confer with Ohio EPA regarding any differences. Within three (3) weeks after receipt of Ohio EPA's approval of the plan, CSXT shall have the preliminary field system in operation. If the Ohio EPA does not

find the plan to be approvable, and if the parties cannot resolve their differences in a manner which allows CSXT to proceed with a preliminary field system as required herein, the parties will so notify the Court and this matter shall be returned to the Court's docket, with the exception of the State's monetary claims, which shall be resolved upon payment by CSXT as provided for herein.

The preliminary field system design shall provide for the following:

1. Three wells shall be placed in the unsaturated soils in locations which have been identified as containing the most significant quantities of methylene chloride. These wells shall be tested for their ability to yield soil vapor and their concentration of methylene chloride. The soil vapor yield shall be determined with a portable soil vapor unit which will be operated on each of the wells for approximately two days (six days total). This is a sufficient period to determine the soil vapor flow potential of each well and to collect samples of the soil vapor from the zone of interest for each well.

2. The extraction wells shall be installed at a level immediately above the water table with hollow stem augers. Split-spoon samples will be taken to characterize the soils in which each well will be placed. A five foot-long stainless steel two-inch diameter wire wound well screen shall be placed in the bottom of the boring with two-inch galvanized casing extending

above the ground surface. The wells shall be completed with a four-inch protective casing.

3. Three samples shall be collected during each two-day test; one each at the beginning and end of the first day and one at the end of the second day. These samples will be collected using a double stage charcoal tube and a calibrated air pump so that a precise volume of soil vapor is passed through the charcoal. The laboratory determination of solvent quantity in the charcoal tube plus the soil vapor volume will allow the calculation of concentration in the soil vapor. The second stage of the charcoal tube shall be analyzed to insure that the solvent was trapped in the first stage and a portion of the solvent did not pass completely through the tube.

4. Three half-inch diameter galvanized steel probes shall be installed adjacent to each vapor extraction well to a depth of six feet. These probes will be outfitted with temporary vacuum gauges to further delineate the area of influence of the well.

5. One 55-gallon carbon canister shall be used for treatment of the soil vapor during the above-described preliminary activities. The carbon canister will be disposed of at a licensed disposal facility.

The flow and chemical data collected as part of the preliminary field work will be used to evaluate the effectiveness of a final soil vapor extraction system at the site. If the preliminary field work confirms that such a system is capable of achieving the desired efficiency, as defined below, then CSXT shall, within no later than four (4) weeks of that determination, submit a final system design plan for Ohio EPA's review and approval. Such design plan will be based on the preliminary field work and the professional judgment of CSXT's consultants. Ohio EPA is committed to expeditiously provide any comments it may have on that plan and anticipates that it will comment and will endeavor to comment within five (5) business days of its receipt. If changes are suggested, CSXT either shall adopt those changes and receive Ohio EPA approval of the plan or shall confer with Ohio EPA regarding any differences. If the preliminary field work shows that such a system is not capable of achieving the desired efficiency, as defined below, or if CSXT's consultants' certification, as provided for below, is not concurred with by Ohio EPA, or if Ohio EPA does not find the final design plan to be approvable, as provided for below, then the parties will attempt to reach some other resolution. If some other resolution cannot be reached within thirty (30) days of the determination that a soil vapor extraction system is not capable of achieving the desired efficiency, or thirty (30) days from Ohio EPA's notification of nonconcurrence, or thirty (30) days from Ohio EPA's notification that it found the final design plan to be not approvable, or such longer period of time as mutually

agreed to in writing by the parties, then the parties will so notify the Court and this matter will be returned to the Court's docket, with the exception of the State's monetary claims which shall be resolved upon payment by CSXT as provided for herein.

A soil vapor extraction program shall be deemed to be capable of achieving the "desired efficiency" (which shall be the standard for determining whether such a system should be implemented) if, after the conclusion of the preliminary field work, CSXT has demonstrated the following:

1. Based on field experience and their professional judgment, CSXT's consultants certify that, in their independent professional opinion, conditions at the site are appropriate for application of soil vapor extraction technology to remove methylene chloride from unsaturated soils at the site; and

2. Based on their extrapolations from the data generated during operation of the preliminary field system and their professional judgment, CSXT's consultants certify that, in their independent professional opinion, soil vapor extraction can remove an average of fifteen (15) lbs. per day of methylene chloride from the unsaturated soils at the Zaleski site.

Such certifications shall be made to Ohio EPA for the State's concurrence. The State commits to expeditious review and concurrence and anticipates that it will confirm or not CSXT's

consultants' certifications within five (5) days of such certifications. The parties recognize and agree that the certifications by CSXT's consultants are not a guarantee of the amount of methylene chloride which will ultimately be recovered by the soil vapor recovery system but are the independent exercise of their best professional judgment regarding the applicability and effectiveness of soil vapor extraction technology to the Zaleski site.

If it is determined, based on the preliminary field work, that a final treatment system should be implemented, once Ohio EPA has approved the final design plan, CSXT shall implement that plan within three (3) weeks of receipt of Ohio EPA approval. CSXT shall, thereafter, operate the soil vapor extraction system for eight (8) consecutive operating months, exclusive of maintenance or repair to the system, unless one of the following events occurs, at which time CSXT may cease operation of the system: (1) after six (6) consecutive operating months, exclusive of maintenance or repair to the system, the system's removal rate reaches an inefficient level, as defined below; or (2) prior to six (6) consecutive months of operation, 4000 lbs. of methylene chloride are removed and the system's removal rate reaches an inefficient level, as defined below. CSXT shall repair and maintain the system so that it will operate as designed and, if the system is not operating efficiently, as defined below, the parties will consult concerning repairs or adjustments which might be made to improve its efficiency.

The term "inefficient level" shall be defined as failure of the system to remove methylene chloride from soils at a rate greater than three (3) lbs. per day (lbs./d) for a sustained three (3) week period. Because some minor variations can be expected, the determination of whether this level is "sustained" shall be based on a comparison of the mean removal rate from the most recent four (4) weekly system influent samples to 3 lbs./d using a Student's t-test at a 5% level of significance. The t-test will compare the null hypothesis (statement) that the mean removal rate is equal to or less than three (3) lbs./d to the alternate hypothesis (statement) that the mean removal rate is greater than three (3) lbs./d. If the statistical comparison does not reject the null hypothesis, then further operation of the system will not be required after six (6) months. After CSXT discontinues operation of the system in accordance with the above, the State of Ohio is free to operate the system itself at its own cost and may not seek recovery of those costs from CSXT. If the system reaches an inefficient level due to frozen or saturated conditions, this shall not be considered cause for discontinuing operation of the system.

B. Monitoring. After entry of this Consent Order, CSXT shall monitor site conditions on the following frequency, sampling or monitoring for the presence of methylene chloride:

1. The Village of Zaleski drinking water wells shall be monitored four (4) times a year for two (2) years and two (2) times a year for two (2) years thereafter. At that point, the existing data will be evaluated and CSXT and the State will confer to determine whether monitoring should be discontinued or reduced in frequency with discontinuation to occur later. If the parties cannot agree on the frequency of such monitoring after four (4) years, the State reserves all rights it may have to require CSXT to monitor thereafter and CSXT reserves all rights to oppose additional monitoring.

2. a. Except as provided below in Section III.B.2.b., the groundwater wells at the site shall be monitored four (4) times a year for two (2) years and two (2) times a year for two (2) years thereafter. At that point the existing data will be evaluated and CSXT and the State will confer to determine whether monitoring should be discontinued or reduced in frequency with discontinuation to occur later. If the parties cannot agree on the frequency of such monitoring after four (4) years, the State reserves all rights it may have to require CSXT to monitor thereafter and CSXT reserves all rights to oppose additional monitoring.

b. Except as provided below, no further monitoring of the following wells and sumps will be required: PW-5, PW-6, Sump A, Sump B, Sump C, Sump D, Swamp Sump, OW-4, OW-4A, OW-5, OW-8, OW-8A, OW-16A, OW-16B, and OW-16-C. The five (5)

sumps will be abandoned in conformity with the requirements of the State of Ohio attached hereto as Exhibit A. The wells will, if they are located outside the fence described in Section III.C. below, be welded shut and, if they are located inside the fence, be locked and secured. Only water level monitoring will be conducted in: OW-9, OW-10, OW-11, OW-13A, OW-13B, OW-13C, OW-17 and OW-18. All other wells present upon the entry of this Consent Order which are not among those to be locked or welded shut shall continue to be monitored for both water level and water quality data. The wells that are to be locked or welded or which will only be monitored for water level data may be required to be monitored based upon a demonstration that there has been a significant change in the direction of groundwater or plume flow at the site.

3. Raccoon Creek shall be sampled with the following frequency and at the locations identified in Exhibit B hereto:

YEAR	FREQUENCY
1	Once a month through the completion of the soil vapor extraction program described in Section III.A. above and then quarterly
2	Quarterly, with at least two events occurring during the months from July to October
3-8	Two times a year, with one event occurring in July and the other in October

At that point, the existing data will be evaluated and CSXT and the State will confer to determine whether monitoring should be discontinued or reduced in frequency with discontinuation to occur later. If the parties cannot agree on the frequency of such monitoring after four (4) years, the State reserves all rights it may have to require CSXT to monitor thereafter and CSXT reserves all rights to oppose additional monitoring.

C. Fencing and Signs. Within (six) 6 weeks of entry of this Order, CSXT shall upgrade and extend the site fence so as to enclose the site completely from the toe of the slope to the upper bank of Raccoon Creek. A map indicating the general location of the fence is attached hereto as Exhibit C. "NO TRESPASSING" signs will be prominently posted.

D. Deed Restrictions. Within ten (10) weeks of entry of this Order, CSXT shall place deed restrictions on the portion of the site that it owns. Those restrictions will prevent excavation or the installation of wells on-site. Ohio EPA and the State of Ohio counsel involved in this case agree to contact the State agency(ies) who have control over the portions of the site owned by the State of Ohio and inquire whether that agency(ies) desires to and has authority to place similar restrictions on its property. The deed restrictions will remain in place until CSXT can demonstrate to the satisfaction of Ohio EPA that exposure to methylene chloride through contact with

soils which may be excavated or exposed or use of groundwater on-site will not exceed the then-applicable health-based standard for that media or that conditions at that time do not present an unreasonable risk to public health or the environment. In addition, at such time as the deed restrictions are removed, CSXT shall be allowed to abandon any remaining wells.

E. Cap Repair. Weather permitting, within eight (8) weeks of completion of the soil vapor extraction program described in Section III.A. above, CSXT shall upgrade the site cap. If weather conditions do not allow the cap to be upgraded within that time, CSXT will do so as the weather permits. To accomplish this, CSXT's consultants and Ohio EPA personnel will meet at the site and determine which areas of the cap have been damaged. Those areas will be filled. CSXT then will place a six (6) inch additional layer of cover on top of the existing cap. The capped area will then be revegetated.

F. Release and Covenant Not to Sue. Except as to costs incurred by the State of Ohio with regard to this matter after April 30, 1990, except that the State shall not seek recovery of costs incurred by the State of Ohio in operating the system after it has been discontinued in accordance with Section III.A., and except as provided for in Sections III.B., C., D. and E. above, at the conclusion of the operating period described in Section III.A. above, CSXT's obligations as to this matter shall cease so long as conditions at the Zaleski site do

not change significantly, as defined below, so as to present an imminent and substantial endangerment to public health or the environment. Conditions at the site shall be deemed to have changed significantly if one of the following occurs:

1. The sampling in Raccoon Creek reveals a level of methylene chloride in excess of 9,700 ug/l and CSXT cannot prove to Ohio EPA's satisfaction that the analytical result was not caused by some source other than the 1984 derailment and release of methylene chloride or by laboratory or sampling error; or

2. The Village of Zaleski drinking water wells or private wells used for drinking water in the Zaleski area are contaminated or, based on changed conditions and information not presently available to the State, there is a significant risk they will be contaminated by methylene chloride resulting from the 1984 derailment in excess of the legally applicable drinking water standard in effect at the time or, if there is no legally applicable drinking water standard, methylene chloride in such wells exceeds an excess cancer risk greater than 1×10^{-6}; or

3. Actual exposure to methylene chloride from the site exceeds an excess cancer risk of 1×10^{-6}, in media other than surface water, on-site groundwater or on-site soils.

Provided that a final treatment system is implemented in accordance with this Consent Order, the State of Ohio covenants that during the time CSXT is undertaking the actions required herein, after completion of them and so long thereafter as conditions at the Zaleski site do not change significantly, as defined above, so as to present an imminent and substantial endangerment to public health or the environment, the State of Ohio will take no administrative or judicial action to compel CSXT to undertake any action or to reimburse the State of Ohio for any action taken by the State to investigate, characterize, cleanup or remediate the Zaleski site near Raccoon Creek and State Route 278 in Zaleski, Ohio. This paragraph shall not be construed to bar the State from seeking recovery of costs incurred by the State of Ohio with regard to this matter after April 30, 1990, except that the State shall not seek recovery of costs incurred by the State of Ohio in operating the system after it has been discontinued in accordance with Section III.A.

IV.

In any action to enforce any of the provisions of this Consent Order, CSXT may raise at that time the question of whether it is entitled to a defense that its conduct was caused by reasons beyond its control such as, by way of example and not limitation, act of God, unusually severe weather conditions, strikes, acts of war or civil disturbances, or conflicting orders of any regulatory agency. While the State of Ohio does not agree that such a defense exists, it is, however, hereby agreed upon by

the parties 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 that an enforcement action, if any, is commenced. Acceptance of this Consent Order without a force majeure clause does not constitute a waiver by CSXT of any rights or defense it may have under applicable law.

V.

Compliance with this Consent Order constitutes full and complete satisfaction of the claims alleged in the Complaint relating to or arising out of this matter, which the State has made or could make as claims for injunctive relief or civil penalties for violation of R.C. Chapter 3734 and R.C. Chapter 6111; claims for injunctive relief or a tax under R.C. Chapter 3767; and claims for reimbursement of past response costs through April 30, 1990 under R.C. Chapter 3734.20, 3734.28, 3745.12, or 3745.13, or any claim as to this matter which could have been raised by the Ohio EPA or the Ohio Attorney General for injunctive relief or for past response costs incurred through that date pursuant to the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, 42 U.S.C. § 9601 et seq., or pursuant to common law and the same are hereby discharged as to this matter.

Nothing in this Consent Order shall be construed to limit the authority of the State to seek relief for claims for

damages to natural resources. Except as expressly set forth in this Consent Order, Defendant CSXT reserves any and all of its rights, claims, causes of action, or defenses with respect to any claim made or unmade by the State of Ohio, Ohio EPA, and the Ohio Attorney General.

VI.

CSXT shall pay Court costs.

VII.

All documents and notices to be submitted by CSXT to the State of Ohio shall be submitted to Paul D. Hancock at the Ohio Attorney General's office, Environmental Enforcement Section, 30 East Broad Street, 25th Floor, Columbus, Ohio 43266-0410, Kathy Davidson at Ohio EPA, Central Office, 1800 Watermark Drive, Columbus, Ohio 43266, and Brian Blair at Ohio EPA, Southeast District Office, 2195 Front Street, Logan, Ohio, 43138. All documents and notices to be submitted to CSXT by the State of Ohio shall be submitted to Anthony L. Braden, CSX Transportation, Inc., Risk Management Department, 500 Water Street, Jacksonville, Florida 32202, Keith Meiser, CSX Transportation Inc., Legal Department, 500 Water Street, Jacksonville, Florida 32202, and Peggy L. O'Brien, Sidley & Austin, 1722 Eye Street, N.W., Washington, D.C. 20006.

Entered this 20 day of April, 1990.

MICHAEL BRAME, JUDGE

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3745-9 (EP-7) WATER WELL STANDARDS

3745-9-01 (EP-7-01) Definitions.
3745-9-02 (EP-7-02) Relation to other prohibitions.
3745-9-03 (EP-7-03) Plan approval required.
3745-9-04 (EP-7-04) Location of new wells.
3745-9-05 (EP-7-05) Construction of new wells.
3745-9-06 (EP-7-06) Casing for new wells.
3745-9-07 (EP-7-07) Surface design of new wells.
3745-9-08 (EP-7-08) Startup and operation of wells.
3745-9-09 (EP-7-09) Maintenance and modification of wells.
3745-9-10 (EP-7-10) Abandonment of test holes and wells.
3745-9-11 (EP-7-11) Use of wells for disposal.
3745-9-12 (EP-7-12) Penalties.

3745-9-01 (EP-7-01) Definitions.

For purposes of these Chapters, 3745-9 and 3745-41, the following definitions shall apply:

(A) "Annular Space" means the space between the side of an excavation and the casing or wall of a well, and also means the space between a casing and a liner pipe.

(B) "Board of Health" means the board of health of a city or general health district, or the authority having the duties of a board of health in any city as authorized by Section 3709.05 of the Ohio Revised Code.

(C) "Casing" means a pipe used to exclude unwanted or harmful materials from a well.

(D) "Contaminant" means any substance which, if introduced into ground water, would degrade the quality of said water.

(E) "Director" means the Director of the Ohio Environmental Protection Agency.

(F) "Drive Shoe" means a forged or tempered steel collar with a cutting edge, attached to the lower end of a casing by threading or welding, to protect the lower end of the casing as it is driven.

(G) "Existing Well" means any well construction of which was commenced before February 15, 1975.

(H) "Ground Water" means any water below the surface of the earth in a zone of saturation.

(I) "Grout" means a slurry of cement, clay, or other material impervious to and capable of preventing movement of water.

(J) "New Well" means any well construction of which was commenced after February 14, 1975.

(K) "Nonpotable Water" means water which is not potable water as defined herein.

(L) "Person" means the State, any municipal corporation, political subdivision, public or private corporation, individual, partnership, firm, association, or other entity.

(M) "Pitless Installation Device" means an assembly of parts which will permit water to pass through the casing or extension thereof; provides access to the well and to the parts of the water system within the well; and provides for the transportation of the water and the protection of the well and water therein from surface or near-surface contaminants and from freezing or extremes of temperature.

(N) "Potable Water" means water which is satisfactory for drinking, culinary, and domestic purposes.

(O) "Surface Water" means any water on the surface of the earth.

(P) "Test Hole" means any excavation, regardless of design or method of construction, done for the purpose of determining the most suitable site for removing ground water from an aquifer, or for the

EXHIBIT A

purpose of determining the quality, quantity, or level of ground water on a single occasion.

(Q) "Well" means any excavation, regardless of design or method of construction, done or used for the purpose of removing ground water from an aquifer, or for the purpose of determining the quality, quantity or level of ground water on a continuing basis.

(Adopted January 10, 1975; effective February 15, 1975)

3745-9-02 (EP-7-02) Relation to other prohibitions.

No provision of Chapter 3745-9 or Chapter 3745-41, and no waiver issued under Chapter 3745-41, shall be construed so as to exempt any person from compliance with any section of the Ohio Revised Code, or any other regulation of any state department, including the Ohio Department of Natural Resources and the Ohio Department of Health, or any local ordinance or regulation dealing with wells.

(Adopted January 10, 1975; effective February 15, 1975)

3745-9-03 (EP-7-03) Plan approval required.

(A) No person shall construct a new well, except a well for fewer than four residential units or a well the water from which is not intended for human consumption, until plans therefor have been approved by the Director in accordance with Ohio Revised Code Section 6111.44 and Chapter HE-33 of the Regulations of the Ohio Environmental Protection Agency.

(B) The Director shall not approve any plan that does not conform to the requirements of these Chapters, EP-7 and EP-35, and any additional requirements that the Director determines are necessary to protect the health of persons using water from the proposed well, or to prevent contaminants from entering ground water.

(Adopted January 10, 1975; effective February 15, 1975)

3745-9-04 (EP-7-04) Location of new wells.

(A) A new well shall be located only where the new well and its surroundings can be maintained in a sanitary condition, and only where surface and subsurface conditions will not allow contaminants to be conducted into the well.

(B) A new well shall be so located that the well is accessible for cleaning, treatment, repair, testing, and such other attention as may be necessary. A new well shall not be located within the foundation of a building, except a building constructed solely to house pumping and water system equipment.

(C) If plan approval is required therefor by 3745-9-03,

(1) the new well shall be located at such distances from known or possible sources of contaminants as the Director determines are necessary to safeguard the health of persons using water from the well, and to prevent contaminants from entering ground water, and

(2) the owner or operator of the new well shall obtain and retain control of the land surrounding the well, to such a distance as the Director determines to be necessary for protection of the well from entrance of contaminants that may exist or occur in the vicinity thereof.

(D) If no plan approval is required therefor by 3745-9-03, a new well shall not be located within fifty feet of any known or possible source of contaminants, and shall be located at least twenty-five feet from the normal driving surface of any public road.

(Adopted January 10, 1975; effective February 15, 1975)

3745-9-05 (EP-7-05) Construction of new wells.

(A)(1) If no plan approval is required therefor by 3745-9-03, a new well shall either con-

tain casing, or shall have sturdy watertight walls of laid-up brick, stone, concrete, or vitreous clay tile.

(2) If plan approval is required therefor by 3745-9-03, a new well shall contain casing.

(B) If casing is used in a new well, all joints shall be watertight. Casing shall extend continuously to a depth of not less than twenty-five feet, unless the only aquifer yielding water adequate for the needs of the person who intends to use the well is at a lesser depth, in which instance the casing need only extend into such aquifer, but in no instance shall casing extend less than fifteen feet in depth.

(C) If nonpotable water is encountered

(1) *above* an aquifer containing potable water, the casing shall extend to the bottom of the aquifer containing the nonpotable water, or as deep as necessary to prevent the nonpotable water from entering the aquifer containing potable water and to comply with the requirements of paragraph (B) above.

(2) *below* an aquifer containing potable water, the lower portion of the new well shall be filled with grout to a height sufficient to prevent entrance of nonpotable water into the aquifer containing potable water.

(D) All annular spaces shall be completely filled with grout from the ground surface to the top of the aquifer from which water is to be extracted. All annular spaces shall be sufficiently large that the requirements of the preceding sentence can be complied with.

(E) In the process of driving casing for a new well, or for a test hole which may be converted into a well, a drive shoe or a well point shall be used. If a well is being developed in rock formations, and if casing is being driven, the casing shall be firmly seated and sealed in the rock by means of the drive shoe.

(F) If any device containing openings, including but not limited to a strainer or perforated pipe, is used for the purpose of allowing water to enter the well, such openings shall not extend higher than twenty-five feet below the ground surface, unless water is to be obtained from an aquifer at a lesser depth, and in no instance shall such openings extend higher than fifteen feet below the ground surface.

(G) If a wall is constructed, it shall extend to the aquifer from which water is to be extracted, or to a depth of fifteen feet, whichever is greater. The annular space shall be completely filled with grout from the ground surface to a depth sufficient to prevent entrance of surface water into any aquifer, and in no case shall the grout extend less than fifteen feet in depth. The annular space shall be sufficiently large that the requirements of the preceding sentence can be complied with.

(H) If the Director determines that any well, any part of a well, or any appurtenance thereto is being constructed in such a fashion that contaminants may enter ground water, the Director may issue an order to have such additional work performed on the well, including filling the well as described in 3745-9-10 (B) and (C), as he deems necessary to insure that contaminants do not enter ground water.

(Adopted January 10, 1975; effective February 15, 1975)

3745-9-06 (EP-7-06) Casing for new wells.

(A) Casing and liner pipe for new wells shall be sufficiently sturdy to resist the forces imposed upon the casing and liner pipe during installation and those forces and conditions which can normally be expected after installation.

(B) The thickness of steel used for casing and liner pipe for new wells shall be selected in accordance with good design practice as applied to conditions encountered in the area where the new well is located. In no event shall steel casing thicknesses and weights be less than as shown in the following table [Table 1]:

TABLE 1

Casing Recommended for Use Where Hard Driving or Corrosive Waters May Be Encountered

(Known as Drive Pipe, Driven Well Pipe, Standard Pipe, Line Pipe, or Reamed and Drifted Pipe)

Nominal Size in Inches	Outside Diameter in Inches	Wall Thickness in Inches	Weight of Plain End Casing in lbs/ft
1.000	1.315	0.133	1.68
1.250	1.660	0.140	2.27
1.500	1.900	0.145	2.72
2.000	2.375	0.154	3.65
2.500	2.875	0.203	5.79
3.000	3.500	0.216	7.58
3.500	4.000	0.226	9.11
4.000	4.500	0.237	10.79
5.000	5.563	0.258	14.62
6.000	6.625	0.280	18.97
8.000	8.625	0.277	24.70
10.000	10.750	0.279	31.20
12.000	12.750	0.330	43.77
14.000	14.000	0.375	54.57
16.000	16.000	0.375	62.58

Casing Suitable for Driving Where Conditions Are Favorable

(Known as Water Well Casing)

Nominal Size in Inches	Outside Diameter in Inches	Wall Thickness in Inches	Weight of Plain End Casing in lbs/ft
3.500	3.500	0.125	4.51
4.000	4.00	0.134	5.53
4.500	4.50	0.142	6.61
5.500	5.50	0.142	8.13
6.000	6.00	0.142	8.88
6.625	6.625	0.156	10.78
8.625	8.625	0.188	16.94

Casing of a nominal size not listed in the above table shall have a thickness not less than that required for the next smaller nominal size listed.

(C) Materials other than steel may be used as casing or liner pipe for new wells only if a waiver has been obtained from the Director under 3745-41-02 and 3745-41-03.

(D) Defective or visibly damaged pipe shall not be used as casing or liner pipe for new wells. Pipe withdrawn from another well or test hole may be used as casing or liner pipe for new wells provided such pipe meets the requirement of the preceding sentence and all other requirements set forth in this regulation, 3745-9-06. Pipe that has become impregnated with any contaminant, including but not limited to natural gas and crude oil, during a previous use shall not be used as casing or liner pipe for new wells.

(E) Casing for new wells that is of riveted construction shall have all seams and rivets welded in order to insure water tightness.

(Adopted January 10, 1975; effective February 15, 1975)

3745-9-07 (EP-7-07) Surface design of new wells.

(A) The casing or wall of a new well, or the pitless installation device attached thereto, shall extend above the ground surface to a height sufficient to prevent entrance of surface water into the well, and in no event shall the casing, wall, or pitless installation extend less than eight inches above the ground surface.

(B) If the new well contains casing, and if water is to be conducted away from the new well below ground level, a pitless installation device that meets the requirements of the Pitless Adapter Division of the Water Systems Council or of the National Sanitation Foundation shall be used.

(C) If a well vent is used, the outer end shall be extended to the outside air, turned downward, and covered with fine mesh screen. The outer end shall be located at a height sufficient to prevent entrance of surface water into the vent, and in no event shall the outer end of the vent be

located less than eight inches above the ground surface.

(D) All well pumps shall be designed and installed so as to prevent entrance of contaminants into the well at any time.

(E) New wells shall be completed in such a manner as will prevent contaminants from entering the top of the well.

(F) If plan approval is required therefor by 3745-9-03,

(1) the pump of a new well shall not take suction on the casing in such a manner that a vacuum is created within the casing, and

(2) the new well shall be equipped in such a fashion that water samples may be obtained from the well at a point in the water system before any storage, processing, or treatment of the water takes place, and

(3) the new well shall be equipped in such a fashion that the water level in the well may be measured.

(Adopted January 10, 1975; effective February 15, 1975)

3745-9-08 (EP-7-08) Startup and operation of wells.

(A) New wells shall be disinfected upon completion of construction in a manner satisfactory to the Director.

(B) If plan approval is required therefor by 3745-9-03, a new well shall be sampled for coliform group bacteria in a manner satisfactory to the Director before water is first taken from the well for human consumption. No water shall be supplied from said well for human consumption until the sampling demonstrates the absence of bacteria in harmful amounts.

(C) Only potable water shall be used for priming pumps.

(Adopted January 10, 1975; effective February 15, 1975)

3745-9-09 (EP-7-09) Maintenance and modification of wells.

(A) Casings and the tops of wells shall be protected against entrance of contaminants at all times.

(B) If a casing deteriorates to such an extent that contaminants may enter the well, the casing shall be replaced, or the well shall be completely filled with grout.

(C) If any part of the pump or any connection malfunctions or becomes defective in such a fashion that contaminants may enter the well, the pump or connection shall be promptly repaired or replaced as necessary to prevent contaminants from entering the well.

(D) (1) Wells shall be disinfected in a manner satisfactory to the Director after maintenance or modification is performed, and before water is taken from the well for use.

(2) If the well is of such a use that its construction would require plan approval under 3745-9-03, the well shall be sampled for coliform group bacteria in a manner satisfactory to the Director after maintenance or modification is performed, and before water is taken from the well for human consumption. No water shall be supplied from said well for human consumption until the sampling demonstrates the absence of bacteria in harmful amounts.

(E) Exiting wells not in compliance with the requirements set forth in 3745-9-07 shall be improved so as to meet such requirements

(1) If the top of the casing is buried, when excavation is done to expose the top of the casing, or

(2) in all other instances,

(a) whenever a drilling rig is placed over the well, or

(b) whenever the pump is removed for any purpose, and the well is to be kept in service.

(F) If casing is installed in a previously-constructed well, either to comply with paragrapn (B) above or for any other purpose, such casing shall meet all requirements of 3745-9-06, and shall be installed in compliance with all requirements of 3745-9-05.

(G) If the Director determines that any well, any part of a well, or any appurtenance thereto has been constructed in such a fashion, or is being maintained in such a fashion, or has deteriorated to such an extent, that contaminants may enter ground water, the Director may issue an order to have such work performed on the well, including filling the well as described in 3745-9-10 (B) and (C), as he deems necessary to insure that contaminants do not enter ground water.

(Adopted January 10, 1975; effective February 15, 1975)

3745-9-10 (EP-7-10) Abandonment of test holes and wells.

(A) Upon completion of testing, a test hole shall be either completely filled with grout or such other material as will prevent contaminants from entering ground water, or converted into a well, construction of which shall comply with all applicable requirements of this Chapter 3745-9.

(B) If a well containing wells is not being used for obtaining ground water or for determining the quality, quantity, or level of ground water, such well shall either be completely filled with grout or such other material as will prevent contaminants from entering ground water, or maintained in strict compliance with all applicable requirements of Regulation 3745-9-09.

(C) All wells not governed by (B) above and which are being used neither for obtaining ground water nor for determining the quality, quantity, or level of ground water shall be either completely filled with grout, or maintained in strict compliance with all applicable requirements of 3745-9-09.

(Adopted January 10, 1975; effective February 15, 1975)

3745-9-11 (EP-7-11) Use of wells for disposal.

No person shall use any well for the purpose of injecting or reinjecting any substance into the ground without first obtaining the necessary permits from the Director in accordance with Chapter 6111 of the Ohio Revised Code and Chapters 3745-3, 3745-31, and 3745-33 of the Regulations of the Ohio Environmental Protection Agency, and from the Department of Natural Resources.

(Adopted January 10, 1975; effective February 15, 1975)

3745-9-12 (EP-7-12) Penalties.

Whoever breaches any duty imposed by Chapter 3745-9 of the Regulations of the Ohio Environmental Protection Agency shall be subject to the penalties set forth in Ohio Revised Code Section 6111.99.

(Adopted January 10, 1975; effective February 15, 1975)

3745-41 (EP-35). WATER WELL WAIVERS

3745-41-01 (EP-35-01) Waivers of certain provisions of 3745-9-05 (EP-7-05).
3745-41-02 (EP-35-02) Waiver of other provisions of Chapter 3745-9 (EP-7).
3745-41-03 (EP-35-03) Grounds for granting waivers.

3745-41-01 (EP-35-01) Waivers of certain provisions of 3745-9-05 (EP-7-05).

(A) Any person desiring a waiver of

(1) the fifteen-foot casing depth requirement of 3745-9-05 (EP-7-05) (B), or

(2) the fifteen-foot perforation or strainer height requirement of 3745-9-05 (EP-7-05) (F), or

(3) the fifteen-foot wall depth requirement of 3745-9-05 (EP-7-05) (G), or

(4) the fifteen-foot grouting depth requirement of 3745-9-05 (EP-7-05) (G)

shall apply to the Director.

(B) All waivers shall be granted or denied within seven (7) days of the Director's receipt of request therefor.

(C) The Director may grant authority to issue waivers to the Board of Health, if he concludes that the Board of Health is willing and able to issue waivers

(1) in accordance with the criteria set forth in 3745-41-03 (EP-35-03), and

(2) in accordance with paragraph (B) above.

In all cases where the Director has granted authority to issue waivers to the Board of Health, references to the Director in paragraphs (A) and (B) above shall be deemed references to the Board of Health.

This paragraph, 3745-41-01 (EP-35-01) (C), shall not apply to wells for the construction of which plan approval is required by 3745-9-03 (EP-7-03).

(D) In all cases where the Director has granted authority to issue waivers to the Board of Health, he shall retain concurrent power to issue waivers. However, neither the Director nor the Board of Health may issue any requested waiver if the other has denied said waiver, and any waiver obtained under such circumstances shall be void, as though it had never been obtained.

(E) The Director may divest any Board of Health of the authority to issue waivers under paragraph (C) above if he concludes that the Board has granted waivers in violation of the criteria set forth in paragraph (C) above.

(Adopted January 10, 1975; effective February 15, 1975)

3745-41-02 (EP-35-02) Waiver of other provisions of Chapter 3745-9 (EP-7).

(A) Any person desiring a waiver of

(1) 3745-9-04 (EP-7-04) (D), or

(2) any provision of 3745-9-05 (EP-7-05) not listed in 3745-41-01 (EP-35-01) (A), or

(3) 3745-9-06 (EP-7-06) (C)

shall apply in writing to the Director.

Applications for waivers shall be in such a form and shall contain such information as the Director may require. An incomplete application will not be considered. Any applicant who submits an incomplete application will be notified within thirty days of receipt of the application of the nature of the insufficiency and of the Director's refusal to consider the application until the insufficiency is rectified.

(B) The Director shall issue a proposed or final action to grant or deny a waiver of the provisions listed in paragraph (A) above within sixty (60) days of the date on which a complete application for a waiver is received, in accordance with the Procedural Rules of the Ohio EPA, Chapter 3745-47 (EP-40).

(Adopted January 10, 1975; effective February 15, 1975)

3745-41-03 (EP-35-03) Grounds for granting waivers.

The Director and the Board of Health shall not grant any waiver unless the applicant demonstrates to the Director's or the Board's satisfaction that

(a) the danger that contaminants will enter ground water as a result of construction and operation of the proposed well is negligible, and

(b) the health of persons using water from the proposed well will not be endangered thereby, and

(c) in the case of waivers of 3745-9-04 (EP-7-04) (D), 3745-9-05 (EP-7-05) (A) (2), or any provision of 3745-9-05 (EP-7-05) listed in 3745-41-01 (EP-35-01) (A), the applicant has no other technically feasible and economically reasonable means of obtaining water, and

(d) in the case of waivers under 3745-9-06 (EP-7-06) (C), the requirements set forth in 3745-9-06 (EP-7-06) (A) are satisfied.

(Adopted January 10, 1975; effective February 15, 1975)

FEATURE

In Situ Decommissioning of Ground Water Monitoring Wells

By Michael E. Renz

The purpose of all monitoring wells is to produce data that is technically and legally valid to aid in the protection and management of our ground water resources. Yet not all monitoring wells are capable of fulfilling this purpose. Wells that have been improperly designed and/or installed, that have deteriorated, or that have been physically damaged may not be capable of producing valid information.

Moreover, such wells may actually threaten ground water quality. Inadequate or damaged surface seals can allow surface contaminants to migrate down the well annulus. Inappropriately long screened intervals may facilitate hydraulic communication between different water-bearing zones, allowing contaminants to migrate into previously unimpacted aquifers. In addition, the inaccurate water quality data produced by such wells may mask the presence of contamination. Therefore, it is imperative that such wells be identified and decommissioned (abandoned) to remove them from the ground water monitoring network.

The method of decommissioning used to remove suspect or incompetent wells from the ground water monitoring network must effectively prevent hydraulic communication between the hydrostratigraphic units that are penetrated by each well and stop infiltration of surface water down the borehole. There are a number of effective methods available for decommissioning wells. Many of these techniques, however, involve the removal of the well casing and screen from the ground and therefore may be inappropriate for closing wells that have come in contact with hazardous contaminants.

In removing contaminated well materials from the ground, the contractor is faced not only with a safety problem, but a disposal problem as well, especially since the casing and screen may be classified as hazardous waste. Therefore, the best option for closing heavily contaminated wells that no longer produce valid or reliable data may be in situ decommissioning.

Before beginning a decommissioning project, it is important to collect as much information as possible regarding the wells to be closed. This would include:

- Well depths
- Casing diameters
- Casing and screen materials
- Screen lengths
- Well identification numbers
- The location coordinates of each well
- Well logs and well construction diagrams.

In addition, data regarding the type and concentration of any contaminants measured in the wells scheduled for decommissioning should also be obtained. This information is required so that the proper protective clothing and safety procedures may be selected. As with all hazardous materials work, having the proper safety training and equipment is a basic requirement of the job.

Every effort should be made to positively identify the wells selected for closure before initiating decommissioning; decommissioning the wrong well can be an expensive and unpleasant experience, especially at a heavily regulated or sensitive facility. The contractor should obtain a list of the wells to decommission along with a map of the facility. The map should be marked by the facility operator to indicate the exact location of each well scheduled to be closed. In addition, the wells scheduled for decommissioning should be flagged with orange surveyor's tape by the facility operator, so that they may be easily identified in the field by the contractor. These measures will allow the contractor to plan an organized approach and will reduce the time and uncertainty involved in locating the designated wells.

Procedures

The method of in situ decommissioning presented is appropriate only under the following conditions:

- Accurate well construction dia-

grams and boring logs are available for each well.
- The well screens are of a known length
- The well screens do not span more than one water bearing unit
- These methods are reviewed and approved by all regulatory agencies involved in the project.

Under other conditions, the following procedures may require modification.

Plastic-Cased Wells

Wells constructed of plastic materials such as PVC, ABS or Teflon®, may be decommissioned in place using the following method:

1. The well to be decommissioned is positively identified. The well number, date, and facility name are marked on a small chalkboard that is placed next to the well and a photograph is taken. The photograph serves to document the pre-decommissioning condition of the well and will be part of the well closure records.

2. The well is sounded and the measured depth is compared to the depth recorded on the well construction diagram to determine if any sediment has accumulated in the well. If a significant amount of in-filling has taken place (a foot or more), a hose fitted with a rigid tip is lowered into the well and the silt is removed by jetting the well with potable water. The quantity of water used in this process should be recorded.

In the case of contaminated wells, arrangements must be made to contain and properly dispose of the water generated during jetting. After jetting, the well is resounded to confirm that all the silt has been removed.

3. The well is filled to approximately 1 foot above the screen with clean silica sand. The volume of sand required is calculated using the following equation: (screen length + 1 foot) x ½ well diameter x ½ well diameter x 3.14 = number of cubic feet of sand required. It is important to use consistent units in making this calculation (i.e., all measurements in feet, including well diameter: 1 inch = 0.083 feet). The sand is measured out and poured down the well slowly to prevent bridging. After the sand has settled, the well is again sounded to confirm that the proper amount of sand has been added.

4. The well is filled with bentonite pellets to approximately 2 feet above the silica sand. This forms a seal above the sand-filled screen. The volume of bentonite pellets is calculated as follows: 2 feet x ½ well diameter x ½ well diameter x 3.14 = number of cubic feet of bentonite pellets required. As with the sand, the pellets are measured out and added to the well slowly to prevent bridging. After the pellets have settled, the well is again sounded to confirm that the proper amount of bentonite pellets have been added. Bentonite pellets, rather than granular or powder, are used since they will sink through the water column and hydrate much slower. Should bridging occur, the bentonite seal may be tamped gently into place.

5. The casing is vertically split into two halves from the surface to within 1 foot of the bentonite seal. This is accomplished by driving a splitting tool attached to a measured string of drill rods down the well. The drill rods are measured and marked so the proper depth of splitting is ensured. The splitting tool is constructed of a 1 foot section of threaded drill rod fitted with two vertically oriented, diametrically opposed blades (Figure 1). Both the lower and upper ends of the blades are cutting edges, so that splitting may be accomplished by either driving or pulling the tool through casing. Length of the blades must be slightly greater than the thickness of the casing. After splitting is completed the well is again sounded to ensure that the well is open and clear to the top of the bentonite seal.

6. The well is then grouted from the bentonite seal up to the surface by inserting a high-pressure grout hose fitted with a rigid tip into the well, until the tip is resting on top of the bentonite seal. Like the drill rods, the hose is measured and marked to ensure that it is placed at the proper depth. The grout is then pumped in, filling the well up from the bottom. The grout should be a bentonite-based product and must be prepared in strict accordance with the manufacturer's directions. The grout is weighed before delivery to confirm that the proper density has been achieved. Pumping of the grout is continued after the well is full, while samples of the overflowing grout are collected and weighed. Once the overflowing grout has been determined to be of the correct density, pumping is terminated and the hose removed. Once the hose has been withdrawn, an additional amount of grout may be required to fill the well to the surface.

7. The protective casing or well

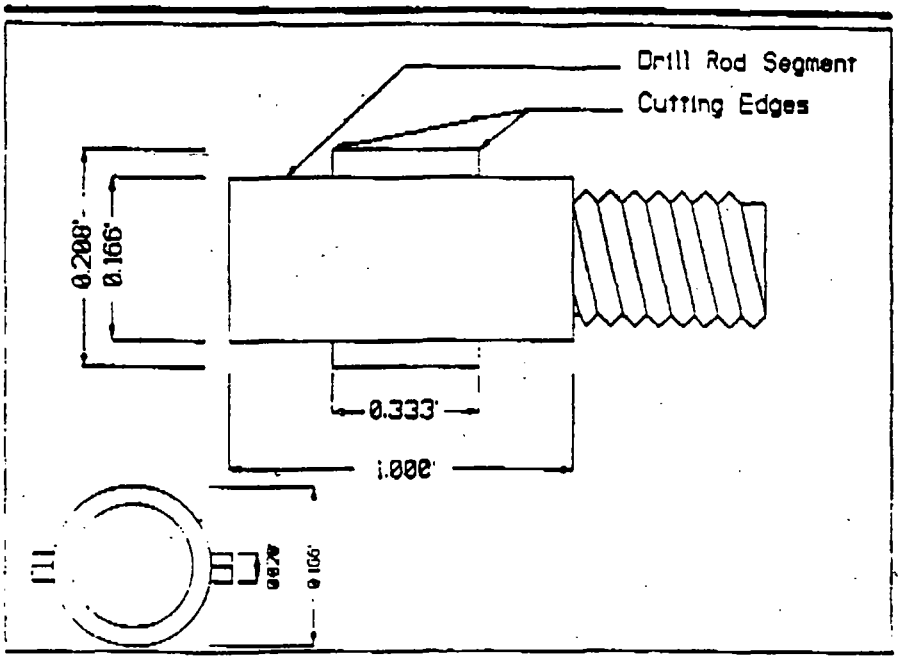

Figure 1. In Situ Decommissioning, Splitting tool/2-inch casing.

protector is removed and the casing is cut off 5 feet below grade. Grout is bailed from the boring until the surface of the grout is approximately 4 feet below grade. After the grout has solidified enough to prevent sinking, a surface seal is formed by filling the open boring to grade with concrete. An iron pin is placed in the top of the seal to aid in the location of the decommissioned well, should it be necessary in the future. The now decommissioned well is again photographed with a chalkboard bearing the well number, date, and facility name to document its closure. In addition, the location of the well is documented by measuring the distance and azimuth of two or more convenient and permanent reference points. Figure 2 illustrates a well decommissioned in situ.

Metal-Cased Wells

With the exception of splitting, metal-cased wells may be decommissioned using the methods described previously. Rather than splitting, metal-cased wells may be cut horizontally every 2 feet from above the bentonite seal. This is accomplished by lowering a casing cutter with a retractable blade attached to a string of drill rods into the well, then extending the blade and rotating the rods until the cut is completed. A common difficulty encountered when using this technique is the inability to retract the cutting blade after completing a cut. This results in the tool becoming stuck in the casing and it may be necessary to either pull the casing from the hole or break off the extended blade. In order to minimize such potential difficulties, it is best to begin the cutting at the top of the well, making successively deeper cuts at 2-foot intervals until reaching the top of the bentonite seal.

Documentation

The closure of ground water monitoring wells frequently is carried out as part of a directive from a regulatory agency; therefore, detailed and accurate documentation of the decommissioning procedures should be maintained. All dates, times, calculations, and measurements should be recorded for each well along with any notes that may be pertinent. In addition photographs of each well should be taken before and after decommissioning. All such records should be provided to the facility operator at the conclusion of the decommissioning project.

Summary

In situ decommissioning may be an effective and efficient method of ground water monitoring well closure when removal of well casing and screen is not desirable or possible. It is important, however, that the suitability of this method for a site be first evaluated by both the facility operator, regulatory authorities and drilling engineers before it is used. Site hydrogeology, well construction, available equipment and regulatory requirements all must be considered. In some cases, the procedures just presented may require modification according to site conditions. When employed properly, in situ decommissioning provides a safe and cost-effective method for closing ground water monitoring wells in place. ■

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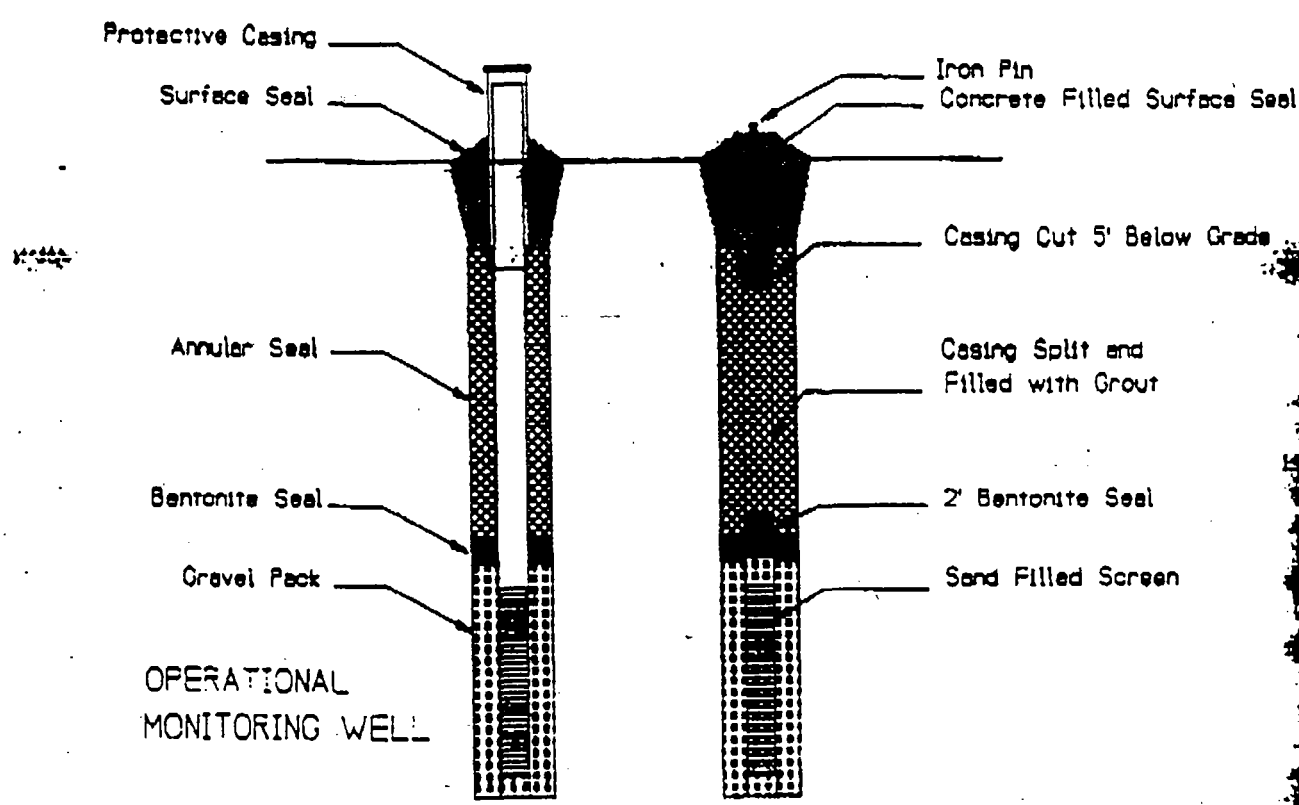


Figure 2. In Situ Decommissioning, Well Diagram.

DRILL BITS

SUMMER 1989

Properly Sealing Unused Wells

This article will address a critical issue relating to all who rely on our ground-water resource for their livelihood - the sealing of unused or abandoned wells. I will try to answer many questions relating to this topic, but it is beyond the scope of this article to get into every aspect of this critical environmental issue.

Today, with much emphasis being placed on proper grouting techniques and materials, a subject of equal importance is that of sealing unused water wells. The scope of this article will address what types of holes and/or wells should be sealed, as well as why and how this can be accomplished. In most cases this will mean the sealing of an abandoned well. Other examples include wells that no longer serve a purpose, such as exploratory or monitoring wells, or wells that need repairs that are not economically feasible. These wells should be properly sealed when a replacement well is drilled.

Many of the reasons for properly sealing unused wells are the same as those regarding proper grouting of wells. These include the prevention of the intermixing of water between aquifers, the prevention of surface contaminants from entering an aquifer, and restoration of an aquifer to as close to the original hydrogeologic condition as possible. One of the most obvious reasons for sealing abandoned water wells is the physical hazard they present to the public. A good example of this danger was seen a few years ago as the nation witnessed the rescue of a small girl from an abandoned water well in Texas. The well in this case was less than 10 inches in diameter.

Many of Ohio's domestic wells fall in the 5-8 inch diameter range, posing a potential for a similar disaster. Other physical hazards involve small animals falling into the smaller 6-inch diameter wells. Using a downhole camera, there have been cases where small animal skeletons (rabbit size), were found at the bottom of an unused well, thus explaining the reason for an unsafe sample in the well or a nearby used well.

An unsafe sample can also be caused when surface contaminants have entered an aquifer through an improperly abandoned well. An example of this would be a contractor called in to diagnose a water supply problem. Upon investigation he found that to recondition the old well would cost more to get a good supply of water than to drill a completely new well. After getting the owner's okay, he moves over several feet from the old well and drills the new one. He then proceeds to dump the cuttings down the old well to seal it. To make a long story short, the new well never produces a safe sample, because the nearby old well was improperly sealed and provided a direct path for contaminants to enter the aquifer.

In the case of a multi-aquifer system where the upper aquifer is contaminated and the lower aquifer is separated from the upper by a restrictive formation, proper well abandonment is a must. In this case, if the upper aquifer is not sealed through the restrictive or confining layer, the potential exists for contamination of the lower aquifer. Contamination occurs because the natural restrictive barrier has been pierced and, if left open, will render both aquifers unusable.

A final reason for properly sealing abandoned wells is to provide restoration of an aquifer to its original hydrogeologic condition. This concept can be illustrated in a region where artesian pressure was once dominant, but through the years as more wells were drilled and abandoned wells were left unsealed or improperly sealed the hydrostatic pressure has dropped. This condition may be evidenced by wells that for years have persistently flowed and have recently stopped flowing. The possibility exists for regional pressure loss from improperly sealed wells where the confined aquifer is discharging to the subsurface, allowing recharge to an upper aquifer whose water quality may be substandard or contaminated.

Like grouting, many procedures and different types of materials can be used to seal an unused well. Basic procedures for sealing an unused well are:

- Remove all equipment such as pumps, pressure lines, etc. that may obstruct the placement and performance of the sealing agent.
- An attempt should be made to remove screens, casings and liners, although in many instances this may be difficult or impossible. If possible, the casing and/or liner should be slit, perforated, or cut to allow the sealing agent to make the best possible seal.
- If the casing cannot be pulled, it should be cutoff below ground level. The depth at which the casing should be cut will depend on whether the well was classified as public or private.
- For best results, a sanitary sealing agent should be placed at the bottom of the well using a tremie pipe. This helps prevent bridging of the sealing agent that typically occurs from pouring the sealing material into the well. As the well borehole is filled the tremie pipe should be moved upward until the entire borehole is sealed. If the tremie pipe method isn't used, then a variety of other types of sealing agents and methods of emplacement are available.
- The location of the abandoned well and the specifics of the sealing procedure should be recorded and then reported to ODNR and other appropriate agencies (Department of Health, Ohio EPA).

Ideally, the material used in sealing an abandoned well should reflect the surrounding geologic formations. Unfortunately, in most instances the formations or their exact depths may not be known. Therefore, it is often hard to match the materials that should be used. Many types of suitable materials are readily available for sealing abandoned wells. Some of these sealants are: clays (either bentonite or other type), neat cement, or a combination of neat cement and bentonite.

In summary, the most important reasons for sealing unused or abandoned wells are to:

- prevent intermixing of water between different aquifers,
- prevent contamination of the aquifer from surface contaminates,
- prevent any physical hazards, and
- restore the aquifer to as close to its original condition as possible.

continued inside

GUEST EDITORIAL

A License to Drill...

The new proposed legislation by the Ohio Department of Health (ODH) which would require drilling contractors to be licensed has set many Ohio drillers up in their chairs. Our first thoughts are: How will more state control affect our business? Will we have delays in our work schedules while we wait on inspectors? The questions can go on forever.

Our business is located in extreme northwest Ohio. Our shop is located 13 miles from Indiana and 14 miles from Michigan. My home is eight miles from Indiana and seven miles from Michigan. It may sound crazy, but to get to some of our job sites in Indiana, we travel thru Michigan to get there. With our location it is necessary to work in all three states to maintain a good working territory.

The purpose of this article is to explain the drilling and licensing policies of Indiana and Michigan. I hope the following information may help inform you as you form your own opinion of the proposed licensing.

Let's start with the state of Michigan. Of all three states, this one is by far the strictest. Each drilling company has to have at least one person holding a license. A fee of $40 for drillers is due every March 1. This fee covers your license and one rig. There is a $10 fee for each additional rig. Each rig must display your company's number and Michigan yearly decal. The licensing program was adopted in 1976, at which time all drillers with two years or more experience were grandfathered in. After this date, a test is required to obtain a license. My father has held a license card since day one. Last year my brother and I decided to get our licenses. Obtaining a license is a complicated and lengthy procedure.

In Michigan, the examination is only given two or three times a year. This year's examination will be in April, July and December. A detailed work history which covers hours worked, types of rigs, work done, pay records, etc. must be completed on forms furnished by the Michigan Department of Public Health. With these records, a driller must prove 100 weeks of experience or 40 hours per week to qualify, or show two full years of experience. These records must be approved by a local health department in Michigan before being submitted. Two personal reference forms, one being a registered contractor, must also be submitted with the work history. Oh, by the way, these have to be signed before a Michigan notary!

These records must be submitted no less than 60 days before the exam. If you are accepted, a time for the exam is assigned. Before the exam a two-day seminar is held. Attendance at the seminar is not required, but it is very helpful. Just for a morale booster, they tell you that in the past, only about 50% of the applicants make it to become licensed.

Finally the big day arrives. Before the exam, each applicant must spend a half hour in a personal interview in which you are asked questions by a panel of drillers and health department officials. If you are rejected by the panel, you are not allowed to take the exam.

The exam itself started at 1 p.m. I finished mine at 4:30 p.m., and it lived up to all of my expectations. The exam covered questions from rules and regulations, identifying formations, well log forms, chlorination, friction loss, pump sizing, etc. When the state of Michigan issues a driller's license, I guarantee that the man is qualified!

I hope I didn't bore you with too many details, but I need to stress how strict Michigan is on their rules and regulations enforcement. Michigan has specific laws and funding to put out for bids for all necessary drilling contractors to solve contamination or well abandonment problems. Drillers from all over the state take part and the problems are solved.

The counties in Michigan also have a certain amount of freedom. The three southern counties we work in all have permitting programs. At any time they may make a final inspection on the well or pump installation. The permit cost ranges from $15-$25 depending on the county. In the past, Michigan has taken a commonsense attitude toward grouting. They have laws in place and require sole well construction, but they are flexible in enforcement by taking geology and contamination into consideration. As in many other states, grouting is being stressed more as time goes on.

In summing up Michigan's laws, strict is the first word that comes to mind. Yes, they are strict, but they are enforced in such a way that nitrate is kept out, allowing equal competition between drillers.

Well it's time to leave Michigan and head west into Bobby Knight's territory-Indiana.

In the past Indiana has had few rules and regulations. Prior to January 1, 1988 drilling in Indiana resembled "Wrestle-mania" - anything goes. On January 1, 1988 a set of rules and regulations were passed into law and the process of education and enforcement began.

The main topics in Indiana's law are licensing of all drillers and a mandatory grouting procedure. To be grandfathered in Indiana, you had to have two years experience, or you were required to submit two reference forms from individual drillers. After that date, if you wish to receive a license, a test is required. I have talked with several drillers who have taken the test. The test required study time and covered a wide range of topics, but would be easily passed by a capable driller. We're talking about a "walk in the park" compared to Michigan. In Indiana, each driller is required to be licensed, with a $100 fee per driller, per year charged.

Mandatory grouting for both rotary and cable tool wells is in effect. For rotary holes the bottom 25 feet of casing must be pump grouted with either neat cement or a Bentonite slurry. The remainder of the hole may be filled with cuttings if care is taken. For cable tool holes, it is suggested that the dry driven grout method be used.

Permits are required in some counties. In one of the counties we work in, the fee is set at $20.

Due to the fact that the law has only been in effect for slightly over a year, it is hard to form a fair evaluation. Let's be realistic-you can't take the main cut of "Wrestle-mania" and put him to playing basketball for Bobby Knight without seeing a few chairs go across the court. After several years when everyone has had time to adjust to the change, I feel as though they will have a good program if enforcement is equal for all.

If you have read this article thinking that you will read my opinion of the proposed law in Ohio at the end, I'm sorry. My purpose was only to give you some information with which to form your own opinion. As a fellow well driller, I would like to ask a favor of you. This is an important issue. Just take a little of your time and voice your opinions, for or against, to your legislators and the Ohio Water Well Association (OWWA). I have been to the OWWA meetings and your opinions are valuable.

In closing, I would like to leave you with a thought. As we look around us we see many jobs which require a license. We see a license required to handle herbicides and pesticides. Does this mean in the past the state of Ohio has been more concerned with the welfare of the cockroaches and quack grass than the safety of our drinking water?

— Jim Watson

Jim has been drilling, both cable tool and rotary, for 23 years. He currently is legally allowed to drill in three states. He presently is vice president of the family business, Watson Well Drilling, Inc., located in Bryan, Ohio.

Continued From Front Page

When I am asked about sealing unused or abandoned wells, I always strongly recommend that the drilling contractor one hires be well versed in well abandonment procedures, techniques and abandonment materials.

With regard to proper procedures, the drilling contractor should realize that the regulations regarding private and public water wells differ slightly. Although the regulations achieve the same result, there are a few differing fine points a contractor must be aware of between the "Private Water Systems Rules" and the Ohio EPA "Water Well Standards Water Well Waivers" (public wells).

If you have specific questions regarding well abandonment contact your local OEPA district office, health department, or myself at (614) 265-6746.

— Douglas J. Barber, Editor

New Ground-Water Maps

The Ohio Department of Natural Resources, Division of Water has published a number of new ground-water maps. These multi-colored maps show the location of ground-water supplies. Many drilling contractors report that they find the maps are a helpful guide to knowing what to expect before setting up the rig. Others report that they take a map with them whenever they talk to customers.

Sixty-seven of Ohio's 88 counties now have maps published by the ODNR Division of Water in a project to map the entire state by 1991. The above chart shows the counties for which maps are available. Single copies of the ground-water maps for a contractor's home county and surrounding counties are available free as a courtesy for filing well logs.

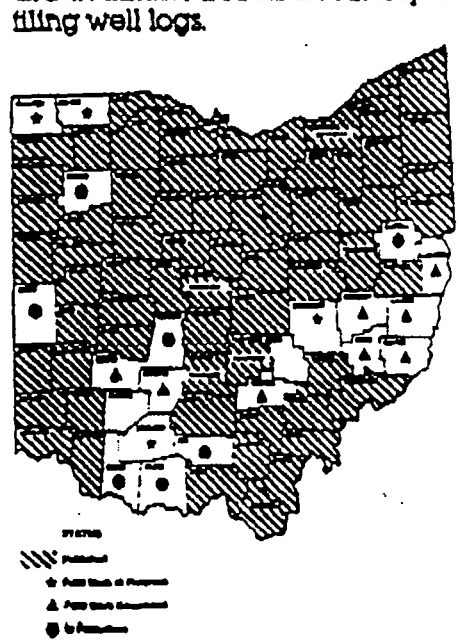


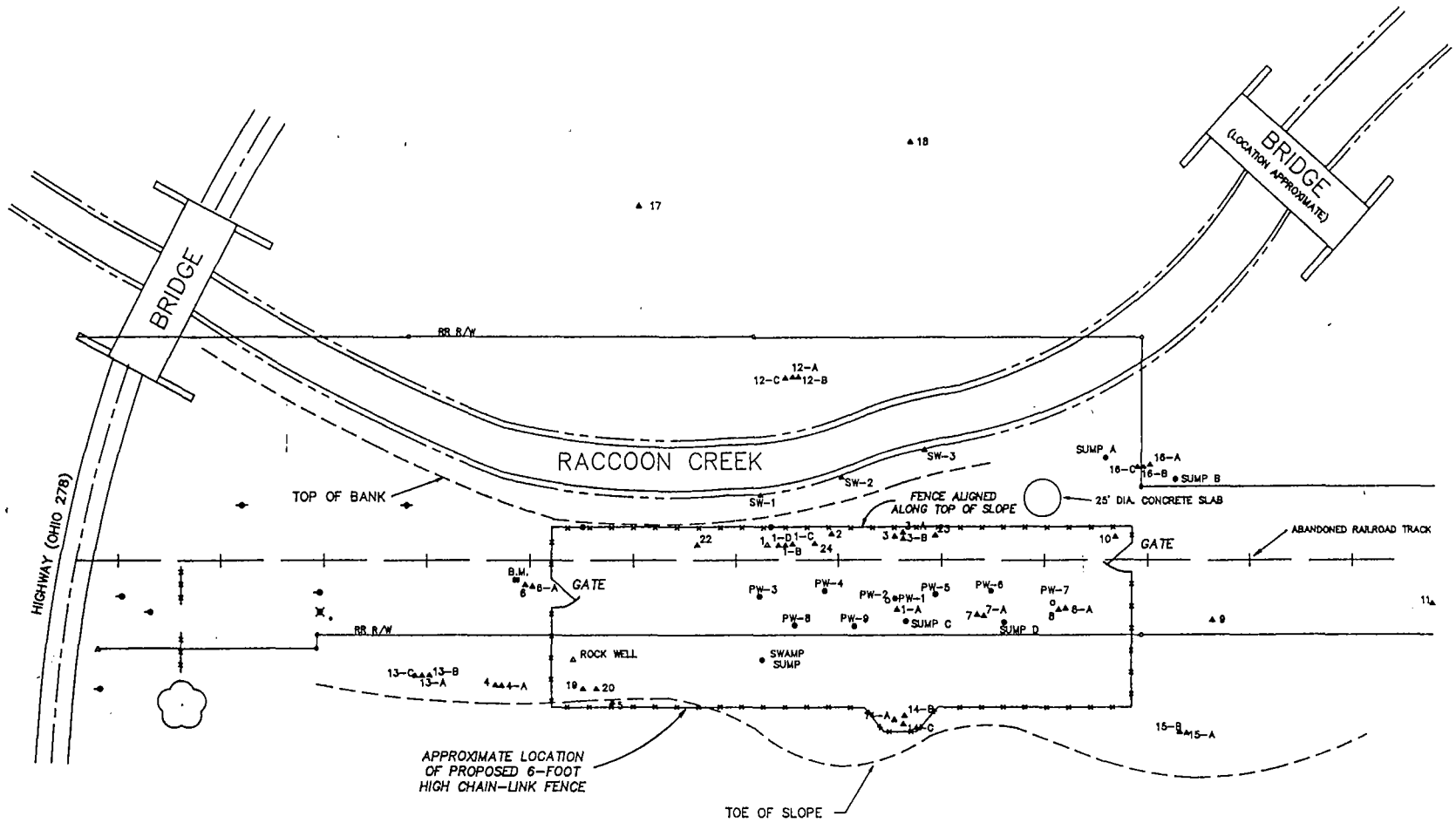
Exhibit B

Raccoon Creek Sampling Stations

Transect	Station[1]
A (Upstream)	1. Mid-point
B (at plume discharge area)	1. West bank 2. One-quarter point 3. Mid-point
C (at Hwy 278 bridge)	1. West bank 2. One-quarter point 3. Mid-point 4. Three-quarter point 5. East bank
D (750 feet downstream of bridge)	1. Mid-point
E (4,000 feet downstream of bridge)	1. Mid-point
F (6,000 feet downstream of bridge)	1. Mid-point

[1]At each station, a vertical composite sample will be collected.

EXHIBIT C



LEGEND

- MONITORING WELL
- ABANDONED WELL
- PURGE WELL
- ABANDONED PURGE WELL
- SOIL BORINGS (1985)
- TELEPHONE POLE
- LIGHT POLE
- POWER POLE
- HOSE BIB
- FENCE

NORTH

0 40 80 160

SCALE IN FEET

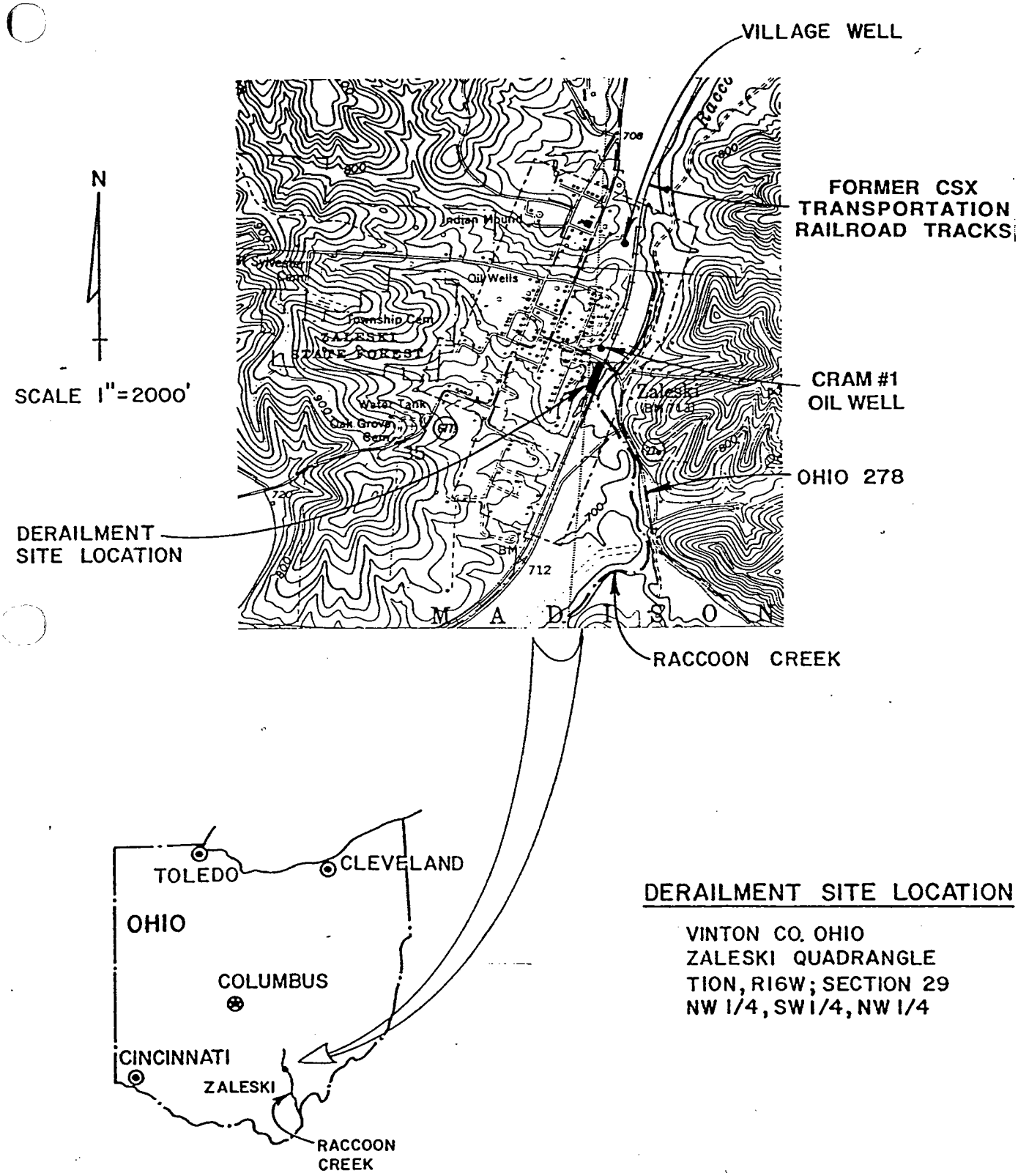
FIGURE 1

SITE MAP SHOWING LOCATION OF PROPOSED FENCE

C S X T
ZALESKI, OHIO

APRIL, 1990 *20649.(*

WW Engineering & Science



DERAILMENT SITE LOCATION

VINTON CO. OHIO
ZALESKI QUADRANGLE
TION, R16W; SECTION 29
NW 1/4, SW1/4, NW 1/4

Figure 1

Derailment Site Location
CSXT
Zaleski, Ohio

January, 1989 20649.01

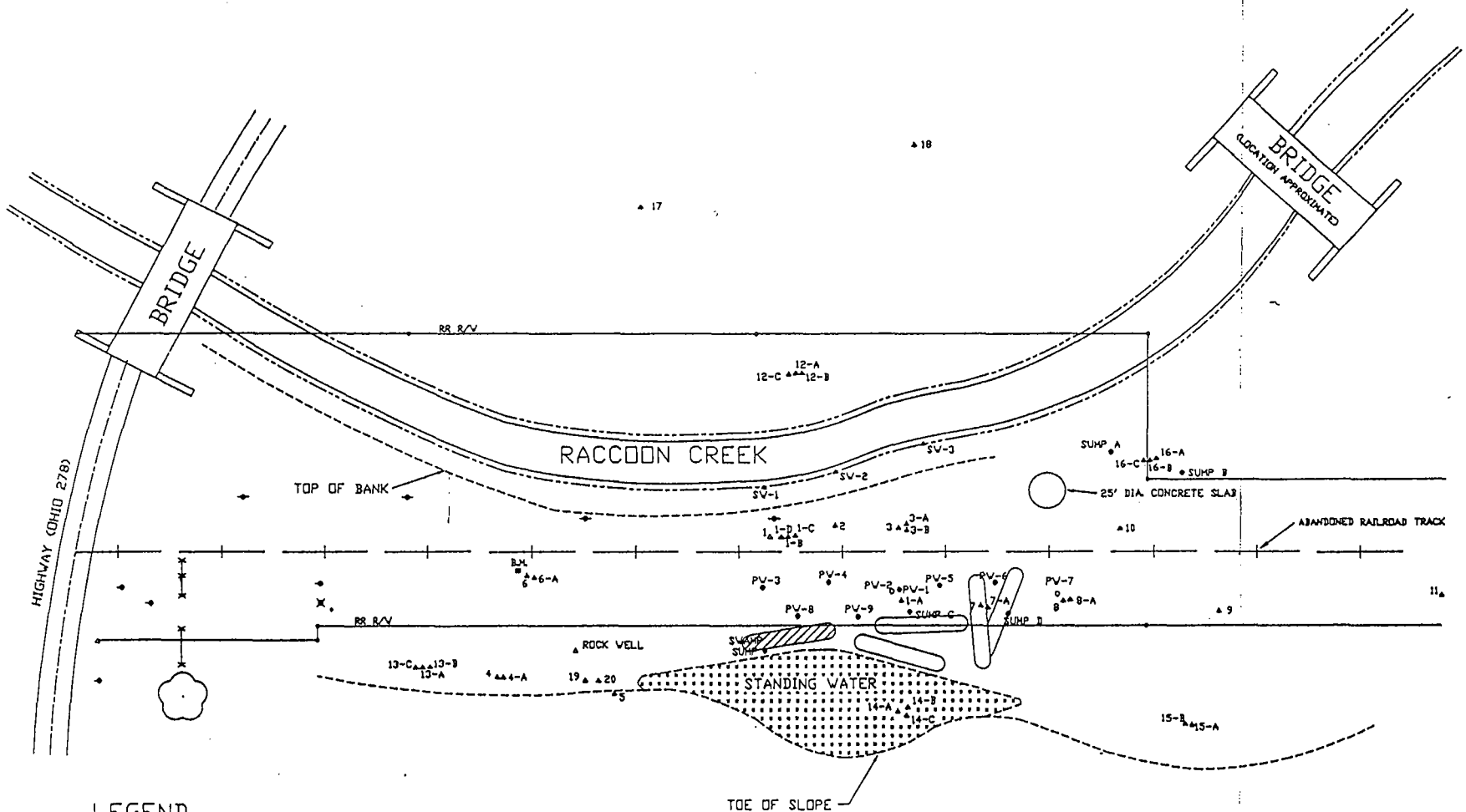


FIGURE 2

SITE PLAN SHOWING DERAILED CARS AND EXISTING WELLS

CSXT
ZALESKI, OHIO

JANUARY, 1989 *20649.01*

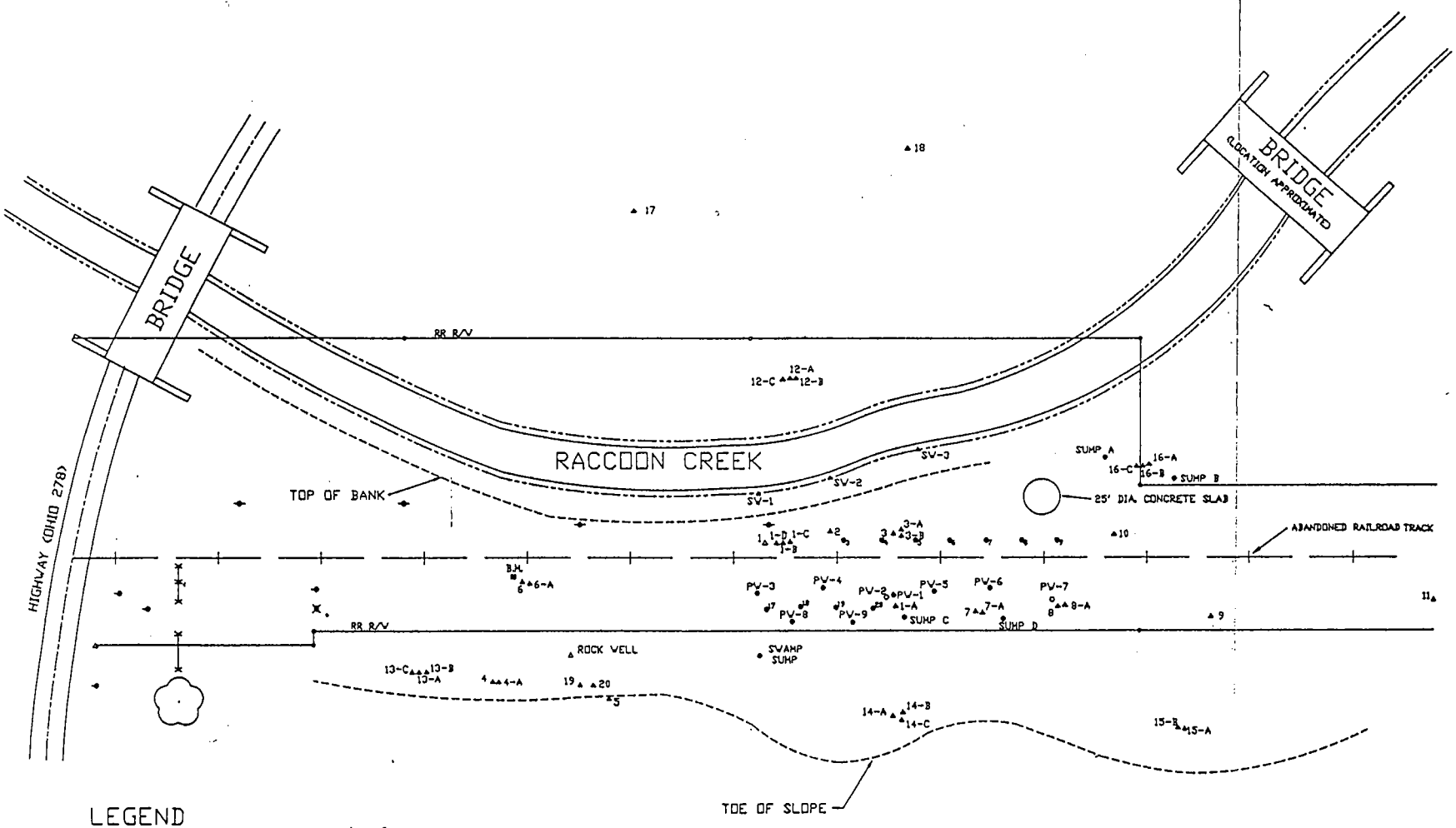


FIGURE 3

SITE MAP

CSXT
ZALESKI, OHIO

JANUARY, 1989 *20649.01*