PROPOSED DECISION TO REISSUE AN EXEMPTION FROM THE LAND DISPOSAL RESTRICTIONS OF THE HAZARDOUS AND SOLID WASTE AMENDMENTS OF 1984 TO VICKERY ENVIRONMENTAL, INC. FOR THE CONTINUED INJECTION OF HAZARDOUS WASTE

Action: Notice of intent to reissue an exemption from the land disposal restrictions of the Hazardous and Solid Waste Amendments of 1984.

Summary: Today, the United States Environmental Protection Agency (EPA) is proposing to reissue to Vickery Environmental Inc. (VEI) of Vickery, Ohio an exemption from the land disposal restrictions under the Hazardous and Solid Waste Amendments of 1984 (HSWA) to the Resource Conservation and Recovery Act (RCRA). If the exemption is reissued, VEI may continue to inject only hazardous wastes designated by the codes in Table 1 through four Class I hazardous waste injection wells #2, #4, #5, and #6. The reissuance as proposed does not include any waste codes that may be identified in the future.

On October 3, 2007, VEI submitted a petition to EPA seeking reissuance of its exemption from the prohibition on injection of restricted hazardous waste (petition) under Title 40 of the Code of the Code of Federal Regulations (40 CFR) part 148, subpart B. As part of its petition, VEI was required to demonstrate, with a reasonable degree of certainty, that there will be no migration of hazardous constituents from the injection zone for as long as the waste remains hazardous. This demonstration requires compliance with 40 CFR § 148.20(a), (b), and (c) which includes, among other things, a showing that any injected fluids will not migrate within 10,000 years: (1) vertically upward out of the injection zone or (2) laterally within the injection zone to a point of discharge or interface with an underground source of drinking water (USDW).

EPA conducted a comprehensive review of VEI's petition, revisions to the petition dated March 2, 2011 and October 20, 2011, and other materials submitted to EPA. Based on its review, EPA determined that VEI has complied with 40 CFR § 148.20(a), (b), and (c). Accordingly, EPA is proposing to reissue VEI's petition to allow the injection of certain restricted hazardous waste through the four Class I hazardous waste injection wells identified above.

Supplementary Information:

I. Background

A. Statutory and Regulatory Requirements

HSWA expanded the scope and requirements of RCRA. Under RCRA section 3004 (d), (e), (f), and (g), 42 U.S.C. 6924(d), (e), (f), and (g), these HSWA prohibit the land disposal of untreated hazardous waste beyond specified dates, unless EPA determines that the prohibition is not required in order to protect human health and the environment. Under RCRA section 3004(k), 42 U.S.C. 6924(k), land disposal includes any placement of hazardous waste into an injection well. After the effective date of prohibition, hazardous waste may be disposed of in a Class I hazardous waste injection well when the owner or operator of such a well has demonstrated that,

to a reasonable degree of certainty, there will be no migration of hazardous constituents from the injection zone for as long as the waste remains hazardous.

Applicants seeking an exemption from the land disposal restrictions must show that the hydrogeological and geochemical conditions at the site and the physicochemical nature of the waste stream(s) are such that reliable predictions can be made that: (a) fluid movement conditions are such that the injected fluids will not migrate within 10,000 years: (1) vertically upward out of the injection zone; or (2) laterally within the injection zone to a point of discharge or interface with an Underground Source of Drinking Water (USDW) (the no-migration standard); or (b) before the injected fluids migrate out of the injection zone or to a point of discharge or interface with USDW, the fluid will no longer be hazardous because of attenuation, transformation or immobilization of hazardous constituents within the injection zone by hydrolysis, chemical interactions or other means.

In addition, the petitioner must comply with the following requirements to demonstrate that there is no migration of hazardous constituents from the injection zone for as long as the waste remains hazardous: (a) establish a 2 mile radius area of review (AOR) around the well bore for class I hazardous waste injection wells; (b) locate, identify, and ascertain the condition of all wells within the injection well's AOR; (c) submit a corrective action plan, if applicable; (d) submit the results of pressure and radioactive tracer tests; (e) identify the strata within the injection zone which will confine fluid movement above the injection interval; (f) show that the strata are free of known transmissive faults of fractures; and (g) identify a confining zone above the injection zone.

B. Facility Information and Operation

VEI operates a commercial waste disposal facility in northeastern Sandusky County, Ohio. The facility disposes of liquid hazardous waste from multiple sources through the use of four Class I hazardous waste injection wells. These wells are currently permitted and operated according to Underground Injection Control (UIC) regulations administered by the Ohio Environmental Protection Agency (Ohio EPA). In 2008, Ohio EPA reissued permits to VEI to dispose of hazardous waste commercially by deep well injection.

The operator has constructed four wells: #2, #4, #5, and #6. The proposed exemption is based on a long term combined maximum injection rate of 240 gallons per minute (gpm), for a total of 10,368,000 gallons per month of hazardous waste identified in Table 1 for all four wells. The rate that VEI injects into each well is also limited by the maximum allowable surface injection pressure at each well.

C. Submission

On October 3, 2007, VEI submitted a petition for exemption from the land disposal restrictions of HSWA. EPA reviewed this submission for completeness and accuracy. After reviewing VEI's petition, EPA provided comments and requested additional information. EPA received a response to its comments and the additional information on March 2, 2011 and October 20, 2011.

II. Basis for Determination

A. Waste Identification, Analysis and Estimation Techniques (40 CFR § 148.22(a)), 40 CFR § 148.21(a)(1) and (2)) – Under 40 CFR § 148.22(a)(1) and (2), any petition must include an identification of the specific waste or wastes, the specific injection well or wells for which the demonstration will be made and a waste analysis to describe fully the chemical and physical characteristics of the subject wastes. In its petition, VEI identified all hazardous waste codes and wells #2, #4, #5 and #6 for which its demonstration was made. VEI included a waste analysis that describes the chemical and physical characteristics of all current hazardous waste codes. EPA proposes to limit VEI's exemption to the waste codes identified in Table 1.

Under 40 CFR § 148.21(a)(1), all waste analysis and any new testing performed by the petitioner must be accurate and reproducible and performed in accordance with quality assurance standards. EPA evaluated VEI's Quality Assurance Plan and determined it to be adequate. Under 40 CFR 148.21(a)(2), estimation techniques must be appropriate, and EPA-certified test protocols must be used where available and appropriate. When precise values necessary for the demonstration were not available, VEI used appropriate estimates to generate conservative results and performed a sensitivity analysis to evaluate their importance.

B. Wells in Area of Review (40 CFR §§ 146.63, 146.64 and 148.20(a)(2)(i), (ii), and (iii)) – Under 148.20(a)(2)(i), the petitioner must show that the injection well's AOR complies with the substantive requirements of 40 CFR § 146.63. 40 CFR § 146.63 requires that the AOR for Class I hazardous waste injection wells shall be a minimum 2-mile radius around the well bore. VEI has demonstrated that the injection wells' AOR complies with 40 CFR § 146.63 by selecting a 5-mile radius as the AOR. VEI's decision to consider a 5-mile radius rather than a 2-mile radius as the AOR is more protective of the environment because VEI is looking at a larger area for penetrations into the confining zone.

Under 40 CFR § 148.20(a)(2)(ii), the petitioner must locate, identify, and ascertain the condition of all wells within the injection well's AOR that penetrate the injection zone or the confining zone and meet the substantive requirements of 40 CFR § 146.64. Substantive requirements of 40 CFR § 146.64 include corrective action if wells are improperly plugged, completed, or abandoned. Under 40 CFR § 148.20(a)(2)(iii), the petitioner must submit a corrective action plan. VEI conducted a well search over the AOR and found that there are six wells penetrating the top of the confining zone within this area. VEI provided completion and plugging reports showing that these six wells are properly constructed or plugged. Accordingly, under 40 CFR § 148.20(a)(2)(iii) and 40 CFR § 146.64, VEI does not need to submit a corrective action plan.

C. Mechanical Integrity Test Information (40 CFR § 148.20(a)(2)(iv)) – Under 40 CFR § 148.20(a)(2)(iv), the petitioner must submit the results of pressure and radioactive tracer tests performed within one year prior to submission of the petition demonstrating the mechanical integrity of the wells' long string casing, injection tubing, annular seal, and bottom hole cement[1]. In cases where the petition has not been approved or denied within one year after the initial demonstration of mechanical integrity, EPA may require the owner or operator to perform the

[1] "Bottom hole cement" refers to the cement at the bottom of the casing which seals the space between the base of the casing and the rock which surrounds it.

tests again and submit the results of the new tests. VEI conducted mechanical integrity tests on wells #2 and #4 in May of 2007 and on #5 and #6 in June 2007. These tests were performed within one year prior to VEI's petition submission and the results from these tests confirmed that all injected fluids were entering the approved injection interval and not channeling up the well bore out of the injection zone. Each year, VEI submits mechanical integrity test results to Ohio EPA. Ohio EPA provided summaries of VEI's mechanical integrity test results from 2008 – 2014 on wells #2, #4, #5, and #6 to EPA. During this period, well #5 did not pass the mechanical integrity test in 2012 and well #6 did not pass the mechanical integrity test in 2013. VEI shut down the wells and made the necessary repairs to wells #5 and #6. Well #5 passed a mechanical integrity test on June 12, 2013 and well #6 passed its mechanical integrity test on October 23, 2013. Though there was a temporary loss of mechanical integrity for wells #5 and #6, Ohio EPA has concluded that the injected material was contained within the injection interval and there wasn't vertical migration of the material out of the well bore based on radioactive tracer tests and temperature logs. The 2014 tests were passed in May and June.

D. Site-Specific Information (40 CFR §§ 148.20(b) and 148.21(b)) – Under 40 CFR § 148.20(b), the petitioner must identify the strata within the injection zone which will confine fluid movement above the injection interval and include a showing that this strata is free of known transmissive faults of fractures. The petitioner must also show that there is a confining zone above the injection zone. Under 40 CFR § 148.21(b), the petitioner must provide sufficient site-specific information to support the demonstration that there will be no migration of hazardous constituents from the injection zone for as long as the waste remains hazardous. VEI identified the Rome, Conasauga, Kerbel, and Knox Formations as the strata within the injection zone which will confine fluid movement and, as discussed below, showed that the strata is free of transmissive faults or fractures. In support of its demonstration, VEI provided site-specific geologic, hydrologic, and geochemical information, including descriptions of the depositional environments of the formations, well logs, cross-sections, well and formation tests, and geologic maps. A summary of the site-specific information is provided below.

1. Identification of Underground Sources of Drinking Water (USDW) – The lowermost USDW at the site is the Lockport Formation, the base of which is at approximately 574 feet below ground level (see Figure 1). There are approximately 2,229 feet of rock between the lowermost USDW and the Injection Interval, where the waste is emplaced. This separation zone is composed of dolomites, shales, sandstones, and siltstones which are predominantly characterized by low permeability at this location.

2. Injection Zone – The injection zone is defined as "a geological 'formation', group of formations, or part of a formation receiving fluids through a well." The injection zone must have sufficient permeability, porosity, thickness, and extent to contain the injected fluids. The injection zone for the VEI facility is composed of the Rome, Conasauga, Kerbel, and Knox Formations and the Mt. Simon Sandstone, between 2360 and 2950 feet below ground level. (All depths are from well #2. Depths in the other wells are similar.) The injection zone is composed of the injection interval and the overlying containment interval (Figure 1). The injection interval is located at depths between 2803 and 2950 feet below ground level and is where the waste is directly emplaced. The injection interval can accept the waste because of its high permeability, porosity and the extent and thickness.

The containment interval ranges from 2360 to 2803 feet below ground level and is composed of the Rome, Conasauga, Kerbel, and Knox Formations. These formations are continuous rock formations of low vertical permeability, and are free of known transmissive faults or fractures over an area sufficient to prevent the upward movement of waste.

3. Confining Zone –The regulations which specify the minimum criteria for siting Class I hazardous waste injection wells require that the injection zone must be overlain by at least one additional formation which can confine the injected fluids. This formation is known as the confining zone, and it must be (1) laterally continuous, (2) free of transecting, transmissive faults or fractures over an area sufficient to prevent fluid movement, and (3) of sufficient thickness and lithologic and stress characteristics to prevent vertical propagation of fractures. The confining zone at the VEI facility, composed of the Black River and Wells Creek Formations, is found between 1816 and 2360 feet below ground level (Figure 1). It is 544 feet thick, has no known transmissive faults or fractures within the AOR, and will resist vertical migration because of its low natural permeability.

The confining zone must be separated from the lowermost USDW by at least one sequence of permeable and less permeable strata that will provide added layers of protection by either allowing pressure bleed-off (permeable units), or by providing additional confinement (low permeability units). The primary "bleed-off" unit is the Trenton Limestone found between 1656 and 1816 feet below ground level. The Trenton Limestone consists of limestone that has sufficient porosity and permeability to be capable of accepting significant amounts of fluid without developing excessive hydrostatic pressure. Overlying the Trenton Limestone is the Cincinnatian Series which is found between 856 and 1656 feet below ground level. The Cincinnatian Series provides additional confinement because it has a much lower porosity and permeability than the Trenton Limestone. These rock formations are laterally continuous for hundreds of square miles and provide the required additional layers of protection.

4. Absence of Known Transmissive Faults – There are no known transmissive faults in the Rome, Conasauga, Kerbel, and Knox Formations, the strata within the injection zone that will confine fluid movement, or in the overlying Black River and Wells Creek Formations. In addition, a seismic reflection survey was conducted from September to December of 1989. The evaluation of the seismic reflections indicated that there is no vertical faulting within this area.

E. Predictive Model

1. Model Development– VEI used the Sandia Waste-Isolation Flow and Transport (SWIFT) Model for Fractured Media for Windows, Verision 2.6 , a subsurface flow and pressure computer modeling program, to simulate migration of injected fluid from wells #2, #4, #5 and #6. VEI used site specific data from logs, core, and other testing carried out during drilling and operation of wells #2, #4, #5 and #6 and site-specific information (i.e. hydrogeologic properties of the various rock layers and formation brines and characteristics of the injected fluid) in its model. When site-specific information was not available, VEI used data from peer-reviewed literature or data from facilities injecting hazardous waste into wells with similar site conditions.

2. Time Period – VEI used two simulated time periods for its demonstration: a 71-year operational period and a 10,000-year post-operational period. The operational period included actual historical injection rates through June 2007 and a combined maximum injection rate of 240 gpm through June 2027. This rate history determined the plume size and maximum pressure build up in the injection zone. The post-operational period predicts the maximum vertical molecular diffusion and the horizontal drift of the waste plumes.

3. Vertical Migration –VEI made conservative assumptions based on the maximum pressure increase of 39 pounds per square inch at the end of the facility's operational life as calculated by the SWIFT model. VEI assumed that this pressure existed during the entire 51 year historical operational period and an additional 20 year predicted operational period, instead of only the end of injection. VEI also assumed that vertical movement begins at the base of the containment interval (which is the top of the injection interval) which is located at 2803 feet below the surface. The vertical permeability of the rocks in the containment interval was measured and it is low. Low vertical permeability is crucial in order to prevent fluid from moving upward. Based on measured values and the assumptions used in the model, VEI predicted vertical movement to be 84 feet above the base of the containment interval at the end of the future operational period.

VEI used conservative assumptions to maximize the distance of the plume for the 10,000 year post-operational period. VEI used the health-based standard to determine the distance at which the constituent would no longer be hazardous (Table 2). Based on these values, VEI predicted the maximum extent of movement to be 195 feet above the injection interval. This amount is much less than the 443-foot thickness of the containment interval (Figure 1).

4. Lateral Migration –The simulation of plume-flow distance and direction during the 10,000 year post-operational period included buoyancy and the natural flow within the Mt. Simon Sandstone as well as dispersion and diffusion. Predictions based on literature values indicated that the rate of regional flow is less than 0.5 ft/year. To maximize plume movement, the model incorporated regional flow in the same direction as the dip of the rock strata, which is to the southeast. For conservatism, the model does not incorporate the possibility of chemical and physical processes which are likely to retard movement of hazardous constituents. The final plume boundary is shown in Figure 2. The boundary is 2.1 miles from the injection wells and represents the likely maximum distance of waste migration within 10,000 years. By simulating the migration of the injected fluid, VEI was able to predict the pressure in the injection interval and the vertical and lateral movement of waste constituents.

5. Model Verification, Validation, Calibration and Appropriateness (40 CFR § 148.21(a)(3)) – Under 40 CFR § 148.21(a)(3), predictive models must be: (1) verified and validated; (2) appropriate for the specific site, waste streams, and injection conditions of the operation; and, (3) calibrated for existing sites. The SWIFT computer codes have been used in previous no-migration demonstrations and have been verified extensively by prior testing which showed that the code accurately represents the mathematical model.

Based on EPA's review of the information provided by VEI, review of the geology by Ohio EPA, and review of the model by Lawrence Berkeley National Laboratory, EPA concluded that

VEI's simulation model is a valid representation of the geology, physical processes and boundary conditions at the site.

VEI calibrated the SWIFT model for its site by adjusting certain parameters such as the permeabilities of various layers to reflect the observed data from pressure transient tests conducted between 1990 and 2006. The model is appropriate for this site because VEI used conservative values for the properties of the individual rock layers (e.g., permeability and porosity), the injection pressure, injection rate and waste stream characteristics (e.g., specific gravity and viscosity).

F. Quality Assurance and Quality Control (40 CFR § 148.21(a)(4)) – Under 40 CFR§ 148.21(a)(4), a quality assurance and quality control plan must address all aspects of the demonstration, which VEI did in its petition. For example, it addressed investigating artificial penetrations, integrity of geological data and core analysis, and reservoir modeling. The quality of the data is indicated by the consistency of the values. VEI followed an appropriate protocol for locating records for penetrations in the AOR, for collection and analyses of geologic and hydrogeologic data, for waste characterization, and for all tasks associated with the modeling demonstration.

G. Conservative values (40 CFR § 148.21(a)(5)) – Under 40 CFR § 148.21(a)(5), the petitioner must use reasonable conservative values whenever values taken from the literature or estimated on the basis of known information are used instead of site-specific measurements. As described above, when parameters were uncertain, VEI chose conservative values.

H. Sensitivity Analysis (40 CFR § 148.21(a)(6)) – Under 40 CFR § 148.21(a)(6), the petitioner must conduct a sensitivity analysis to determine the effect that significant uncertainty may contribute to the demonstration. The demonstration must be based on conservative assumptions identified in the analysis. VEI conducted a sensitivity analysis to determine the effect that uncertain parameters may have on its predictive model. VEI used a range of conservative input values for specific gravity, permeability, dispersitivity, porosity, and effective dispersion coefficient. In its sensitivity analysis, VEI demonstrated that the uncertainty in these parameters does not significantly change the predictions for pressure build-up in the injection interval or significantly affect waste migration or waste confinement predictions. Though the uncertainty of the parameters does not have significant effect on the migration of injected fluids, VEI used the conservative assumptions identified in its sensitivity analysis to simulate migration of injected fluid in Wells #2, #4,# 5, and #6.

I. Other information in support of petition (40 CFR **§ 148.22(a)(3))** – Under 40 CFR § 148.22(a)(3), EPA may require additional information to support the petition. Ohio EPA provided documentation related to the mechanical integrity of the VEI wells after receipt of the petition. VEI provided reports on the pressure fall-off tests performed in the VEI wells. This information showed that the wells are operating as intended. EPA also received monitoring well data from both Ohio EPA and from VEI to verify that there has been no contaminant migration after receipt of the petition.

III. Conclusion

After a detailed and thorough review of the submitted petition and supporting documents, VEI's predictive model, and other information contained in the administrative record, EPA has determined that VEI has demonstrated, to a reasonable degree of certainty, that hazardous constituents will not migrate vertically out of the injection zone or laterally to a point of discharge in a 10,000-year period. Therefore, EPA proposes to reissue VEI's land ban exemption.

IV. Conditions of Petition Approval

This proposed reissuance of the land ban exemption for the continued injection of restricted hazardous waste is subject to the following conditions, which are necessary to assure compliance with the standard in 40 CFR § 148.20(a). EPA may terminate this exemption under 40 CFR § 148.24(a) for noncompliance by VEI with any condition of this exemption. EPA may also terminate this exemption for any causes identified under 40 CFR § 148.24(a) and (b). If VEI wants to modify any of the conditions placed on the exemption, it must submit a petition for reissuance to EPA as required by 40 CFR § 148.20(e) and (f).

1) The exemption applies to the four existing hazardous waste injection wells, #2, #4, #5, and #6 located at the VEI facility at 3956 State Route 412, Vickery, Ohio;

2) Injection of restricted hazardous waste is limited to the part of the Mt. Simon Sandstone at depths between 2791 and 2950 feet below the surface level;

3) Only restricted wastes designated by the RCRA waste codes found in Table 1 may be injected;

4) Maximum concentrations of chemicals that are allowed to be injected are listed in Table 2;

5) The average specific gravity of the injected waste stream must be no less than 1.08 over a three month period;

6) The cumulative volume of wastes injected into wells #2, #4, #5, and #6 must not exceed 10,368,000 gallons per month;

7) This exemption is approved for the 20 year modeled injection period, which ends on June 30, 2027. VEI may petition EPA for a reissuance of the exemption beyond that date, provided that a new and complete petition and no-migration demonstration is received at EPA, Region 5, by January 31, 2027;

8) VEI must submit a quarterly report to EPA containing the fluid analyses of the injected waste and indicate the chemical and physical properties, including the concentrations, of all the injected hazardous constituents listed in Table 2;

9) VEI must submit to EPA an annual report containing the results of a bottom hole pressure

survey (fall-off test) performed on one well each year. The survey must be performed after shutting down the well for sufficient time to conduct a valid observation of the pressure fall-off curve under 40 CFR § 146.68(e)(1). The annual report must include a comparison of reservoir parameters determined from the fall-off test with parameters used in the approved no-migration petition.

10) VEI must annually submit to EPA the results of radioactive tracer surveys and annulus pressure tests for wells #2, #4, #5, and #6;

11) VEI shall notify EPA in writing if any well loses mechanical integrity, prior to any workover or plugging; and,

12) The petitioner must fully comply with all requirements set forth in Underground Injection Control Permits 03-72-009-PTO-I, 03-72-011-PTO-I, 03-72-012-PTO-I, and 03-72-013-PTO-I issued by Ohio EPA.

13) Upon the expiration, cancellation, reissuance, or modification of the permits referenced above, this exemption is subject to review.

14) Whenever EPA determines that the basis for approval of a petition under 40 CFR §§ 148.23 and 148.24 may no longer be valid, EPA may terminate this exemption and will require a new demonstration in accordance with 40 CFR § 148.20.

Date: The EPA requests public comments on today's proposed decision. Comments will be accepted until Friday, JAN 20 2015. Comments postmarked after the close of the comment period will be stamped **"Late"**. Late comments do not have standing and will not be considered in the decision process.

Addresses: Submit written comments by mail to:

Stephen Roy
U. S. Environmental Protection Agency, Region 5,
Underground Injection Control Branch (WU-16J)
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Comments may also be submitted by email to roy.stephen@epa.gov.

For Further Information: Contact Stephen Roy, Lead Petition Reviewer, at the address above, by telephone at (312) 886-6556, or by email at roy.stephen@epa.gov.

Signed and Dated: 12/2/2014

Acting for Tinka G. Hyde
Director, Water Division

Table 1. List of RCRA waste codes approved for injection.

D001	D002	D003	D004	D005	D006	D007	D008	D009	D010	D011	D012
D013	D014	D015	D016	D017	D018	D019	D020	D021	D022	D023	D024
D025	D026	D027	D028	D029	D030	D031	D032	D033	D034	D035	D036
D037	D038	D039	D040	D041	D042	D043	F001	F002	F003	F004	F005
F006	F007	F008	F009	F010	F011	F012	F019	F020	F021	F022	F023
F024	F025	F026	F027	F028	F032	F034	F035	F037	F038	F039	K001
K002	K003	K004	K005	K006	K007	K008	K009	K010	K011	K013	K014
K015	K016	K017	K018	K019	K020	K021	K022	K023	K024	K025	K026
K027	K028	K029	K030	K031	K032	K033	K034	K035	K036	K037	K038
K039	K040	K041	K042	K043	K044	K045	K046	K047	K048	K049	K050
K051	K052	K060	K061	K062	K069	K071	K073	K083	K084	K085	K086
K087	K088	K093	K094	K095	K096	K097	K098	K099	K100	K101	K102
K103	K104	K105	K106	K107	K108	K109	K110	K111	K112	K113	K114
K115	K116	K117	K118	K123	K124	K125	K126	K131	K132	K136	K140
K141	K142	K143	K144	K145	K147	K148	K149	K150	K151	K156	K157
K158	K159	K161	K169	K170	K171	K172	K174	K175	K176	K177	K178
K181	P001	P002	P003	P004	P005	P006	P007	P008	P009	P010	P011
P012	P013	P014	P015	P016	P017	P018	P020	P021	P022	P023	P024
P026	P027	P028	P029	P030	P031	P033	P034	P036	P037	P038	P039
P040	P041	P042	P043	P044	P045	P046	P047	P048	P049	P050	P051
P054	P056	P057	P058	P059	P060	P062	P063	P064	P065	P066	P067
P068	P069	P070	P071	P072	P073	P074	P075	P076	P077	P078	P081
P082	P084	P085	P087	P088	P089	P092	P093	P094	P095	P096	P097
P098	P099	P101	P102	P103	P104	P105	P106	P108	P109	P110	P111
P112	P113	P114	P115	P116	P118	P119	P120	P121	P122	P123	P127
P128	P185	P188	P189	P190	P191	P192	P194	P196	P197	P198	P199
P201	P202	P203	P204	P205	U001	U002	U003	U004	U005	U006	U007
U008	U009	U010	U011	U012	U014	U015	U016	U017	U018	U019	U020
U021	U022	U023	U024	U025	U026	U027	U028	U029	U030	U031	U032
U033	U034	U035	U036	U037	U038	U039	U041	U042	U043	U044	U045
U046	U047	U048	U049	U050	U051	U052	U053	U055	U056	U057	U058
U059	U060	U061	U062	U063	U064	U066	U067	U068	U069	U070	U071
U072	U073	U074	U075	U076	U077	U078	U079	U080	U081	U082	U083
U084	U085	U086	U087	U088	U089	U090	U091	U092	U093	U094	U095
U096	U097	U098	U099	U101	U102	U103	U105	U106	U107	U108	U109
U110	U111	U112	U113	U114	U115	U116	U117	U118	U119	U120	U121
U122	U123	U124	U125	U126	U127	U128	U129	U130	U131	U132	U133
U134	U135	U136	U137	U138	U139	U140	U141	U142	U143	U144	U145
U146	U147	U148	U149	U150	U151	U152	U153	U154	U155	U156	U157
U158	U159	U160	U161	U162	U163	U164	U165	U166	U167	U168	U169
U170	U171	U172	U173	U174	U176	U177	U178	U179	U180	U181	U182
U183	U184	U185	U186	U187	U188	U189	U190	U191	U192	U193	U194
U196	U197	U200	U201	U202	U203	U204	U205	U206	U207	U208	U209
U210	U211	U213	U214	U215	U216	U217	U218	U219	U220	U221	U222
U223	U225	U226	U227	U228	U234	U235	U236	U237	U238	U239	U240
U243	U244	U246	U247	U248	U249	U271	U278	U279	U280	U328	U353
U359	U364	U367	U372	U373	U387	U389	U394	U395	U404	U409	U410
U411											

Table 2. Maximum concentrations of chemical contaminants that are hazardous at less than one part per billion.

Chemical Constituent	Health Based Limit (mg/L)	Maximum Allowable Initial Concentration (mg/L)	Vickery Limit (%)
Acetyl chloride	2.00E-04	2.00E+05	20
Acrylamide (2-Propenamide)	8.00E-06	8.00E+03	0.80
Acrylonitrile (2-Propenenitrile or Vinyl Cyanide)	6.00E-05	6.00E+04	6.00
Aldrin	2.00E-07	2.00E+02	0.02
Allyl Chloride (3-chloroprop(yl)ene)	3.00E-05	3.00E+04	3.00
Bendiocarb (2,2-Dimethyl-1,3-benzodioxol methylcarbamate)	3.00E-04	3.00E+05	30
Benzal chloride	2.00E-05	2.00E+04	2.0
Benz[a]anthracene (1,2-Benzanthracene)	1.30E-04	1.30E+05	13
Benzidine	2.00E-07	2.00E+02	0.02
Benzo[b]fluoranthene	1.80E-04	1.80E+05	18
Benzo[k]fluoranthene	1.70E-04	1.70E+05	17
Benzo[g,h,I]-perylene	7.60E-04	7.60E+05	76
Benzo[a]pyrene	2.00E-04	2.00E+05	20
Benzotrichloride	3.00E-06	3.00E+03	0.30
Benzyl chloride ((Chloromethyl)benzene)	2.00E-04	2.00E+05	20
alpha BHC (see Lindane) alpha-hexachlorocyclohexane	6.00E-06	6.00E+03	0.60
beta BHC (see Lindane) beta-hexachlorocyclohexane	2.00E-05	2.00E+04	2
delta BHC (see Lindane) delta-hexachlorocyclohexane	2.00E-04	2.00E+05	20
Bromoacetone (1-Bromo-2-propanone)	3.00E-05	3.00E+04	3
Bromodichloromethane (Trihalomethane)	6.00E-04	6.00E+05	60
Brucine (2,3-Dimethoxystrychnidin-10-one)	3.00E-04	3.00E+05	30
Carbendazim (1H-benzimidazol-2-yl carbamic acid methyl ester)	4.00E-04	4.00E+05	40
Carbon oxyfluoride	5.00E-04	5.00E+05	50
Chlorinated fluorocarbons, not otherwise specified	5.00E-04	5.00E+05	50
Chloroacetaldehyde	5.90E-04	5.90E+05	59
Chlorodibromomethane	4.00E-04	4.00E+05	40
Chloroethers	3.00E-05	3.00E+04	3
2-Chloroethyl vinyl ether	3.00E-05	3.00E+04	3
Chloromethyl methyl ether	3.00E-05	3.00E+04	3
Chloroprene	3.00E-05	3.00E+04	3
m-Cumenyl methylcarbamate	3.00E-04	3.00E+05	30
Cyclohexane	9.00E-05	9.00E+04	9
2,4-Dichlorophenoxyacetic acid (2,4-D), salts, esters	2.00E-04	2.00E+05	20

p,p'-Dichlorodipheyldichloroethane (p,p'-DDD)	1.00E-04	1.00E+05	10
p,p'-Dichlorodipheyldichloroethylene (p,p'-DDE)	1.00E-04	1.00E+05	10
p,p'-Dichlorodiphehylotrichloroethane (p,p'-DDT)	1.00E-04	1.00E+05	10
Dibenz[a,h]anthracene	3.00E-04	3.00E+05	30
Dibromochloropropane	2.00E-04	2.00E+05	20
2,3-Dibromo-1-propanol phosphate(3:1)	3.00E-04	3.00E+05	30
Dichlorobenzene	2.00E-04	2.00E+05	20
3,3'-Dichlorobenzidine	8.00E-05	8.00E+04	8
sym-Dichloroethyl ether	3.00E-05	3.00E+04	3
sym-Dichloromethyl ether	1.60E-07	1.60E+02	0.016
Dichloropropane	6.00E-05	6.00E+04	6
Dichloropropanol	6.00E-05	6.00E+04	6
Dichloropropene	3.00E-05	3.00E+04	3
cis-1,3-Dichloropropene	3.00E-05	3.00E+04	3
trans-1,3-Dichloropropene	3.00E-05	3.00E+04	3
Dieldrin	2.00E-06	2.00E+03	0.2
Diethylene glycol, dicarbamate	3.00E-04	3.00E+05	30
O,O-Diethyl O-pyrazinyl phosphorothioate	4.00E-04	4.00E+05	40
Dimetilan	3.00E-04	3.00E+05	30
2,6-Dinitrotoluene	3.10E-04	3.10E+05	31
Di-n-octyl phthalate	4.90E-04	4.90E+05	49
Di-n-propylnitrosamine	5.00E-06	5.00E+03	0.5
1,2-Diphenylhydrazine	5.00E-05	5.00E+04	5
Dithiocarbamates (total)	9.00E-04	9.00E+05	90
Ethylene dibromide	5.00E-05	5.00E+04	5
Ethylidene chloride	7.00E-04	7.00E+05	70
Famphur	3.00E-04	3.00E+05	30
Fluoroacetic acid, sodium salt	7.00E-04	7.00E+05	70
Formetanate hydrochloride	3.00E-04	3.00E+05	30
Formparanate	3.00E-04	3.00E+05	30
Heptachlor (and its epoxide)	2.00E-04	2.00E+05	20
1,2,3,4,6,7,8-Heptachlorodibenzofuran	2.50E-05	2.50E+04	2.5
1,2,3,4,7,8,9-Heptachlorodibenzofuran	2.50E-05	2.50E+04	2.5
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	2.50E-05	2.50E+04	2.5
Hexachlorobutadiene	5.00E-04	5.00E+05	50
Hexachlorodibenzo-p-dioxins	2.50E-05	2.50E+04	2.5
Hexaethyl tetraphosphate	4.00E-04	4.00E+05	40
Hydrazine	1.00E-05	1.00E+04	1
Indeno[1,2,3-cd] pyrene	4.30E-04	4.30E+05	43
Isolan	3.00E-04	3.00E+05	30
Lindane (1,2,3,4,5,6-hexa-chlorocyclohexane, gamma isomer)	2.00E-04	2.00E+05	20
Manganese dimethyldithiocarbamate	9.00E-04	9.00E+05	90
Mercury fulminate	1.00E-04	1.00E+05	10
Methiocarb	5.00E-04	5.00E+05	50

Methyl chlorocarbonate	5.90E-04	5.90E+05	59
Metolcarb	3.00E-04	3.00E+05	30
N-methyl-N'-nitro-N-nitroso-guanidine (MNNG)	1.50E-04	1.50E+05	15
Naphthalene	6.00E-04	6.00E+05	60
p-Nitrophenol	1.30E-04	1.30E+05	13
N-Nitrosodiethanolamine	1.00E-05	1.00E+04	1
N-Nitrosodiethylamine	2.00E-07	2.00E+02	0.02
N-Nitrosodimethylamine	7.00E-07	7.00E+02	0.07
N-Nitrosodi-n-butylamine	6.00E-06	6.00E+03	0.6
N-Nitrosomethylethylamine	2.00E-06	2.00E+03	0.2
N-Nitrosomethylvinylamine	1.50E-04	1.50E+05	15
N-Nitroso-N-methylurea	1.50E-04	1.50E+05	15
N-Nitroso-N-methlurethane	1.50E-04	1.50E+05	15
N-Nitrosopyrrolidine	2.00E-05	2.00E+04	2
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	5.00E-05	5.00E+04	5
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin	5.00E-05	5.00E+04	5
Parathion	6.00E-04	6.00E+05	60
Pebulate	8.00E-04	8.00E+05	80
Pentachlorodibenzofurans, total	2.50E-05	2.50E+04	2.5
Pentachlorodibenzo-p-dioxin, total	2.50E-05	2.50E+04	2.5
Pentachlorophenols and their chlorophenoxy derivitive acids, esters amines and salts	7.60E-05	7.60E+04	7.6
1,3-Pentadiene	3.00E-05	3.00E+04	3
Phorate	3.00E-04	3.00E+05	30
Phosgene	2.00E-04	2.00E+05	20
Phosphorithioic and phosphordithioic acid esters	3.00E-04	3.00E+05	30
Physostigmine	3.00E-04	3.00E+05	30
Physostigmine salicylate	3.00E-04	3.00E+05	30
Polychlorinated Biphenyls	5.00E-04	5.00E+05	50
Prosulfocarb	6.00E-04	6.00E+05	60
Reserpine	3.00E-04	3.00E+05	30
Streptozotocin	1.50E-04	1.50E+05	15
Sulfur phosphide	3.00E-04	3.00E+05	30
Tars	3.00E-04	3.00E+05	30
Tetrachlorodibenzofurans	1.00E-05	1.00E+04	1
Tetrachlorodibenzo-p-dioxins	3.00E-08	3.00E+01	0.003
1,1,2,2-Tetrachloroethane	2.00E-04	2.00E+05	20
Tetraethyl lead	3.50E-06	3.50E+03	0.35
Thiodicarb	3.00E-04	3.00E+05	30
Thiofanox	3.00E-04	3.00E+05	30
Tirpate	3.00E-04	3.00E+05	30
Trichlorobenzene	1.20E-04	1.20E+05	12
Trichloromethanethiol	2.00E-04	2.00E+05	20
Triethylamine	5.00E-04	5.00E+05	50

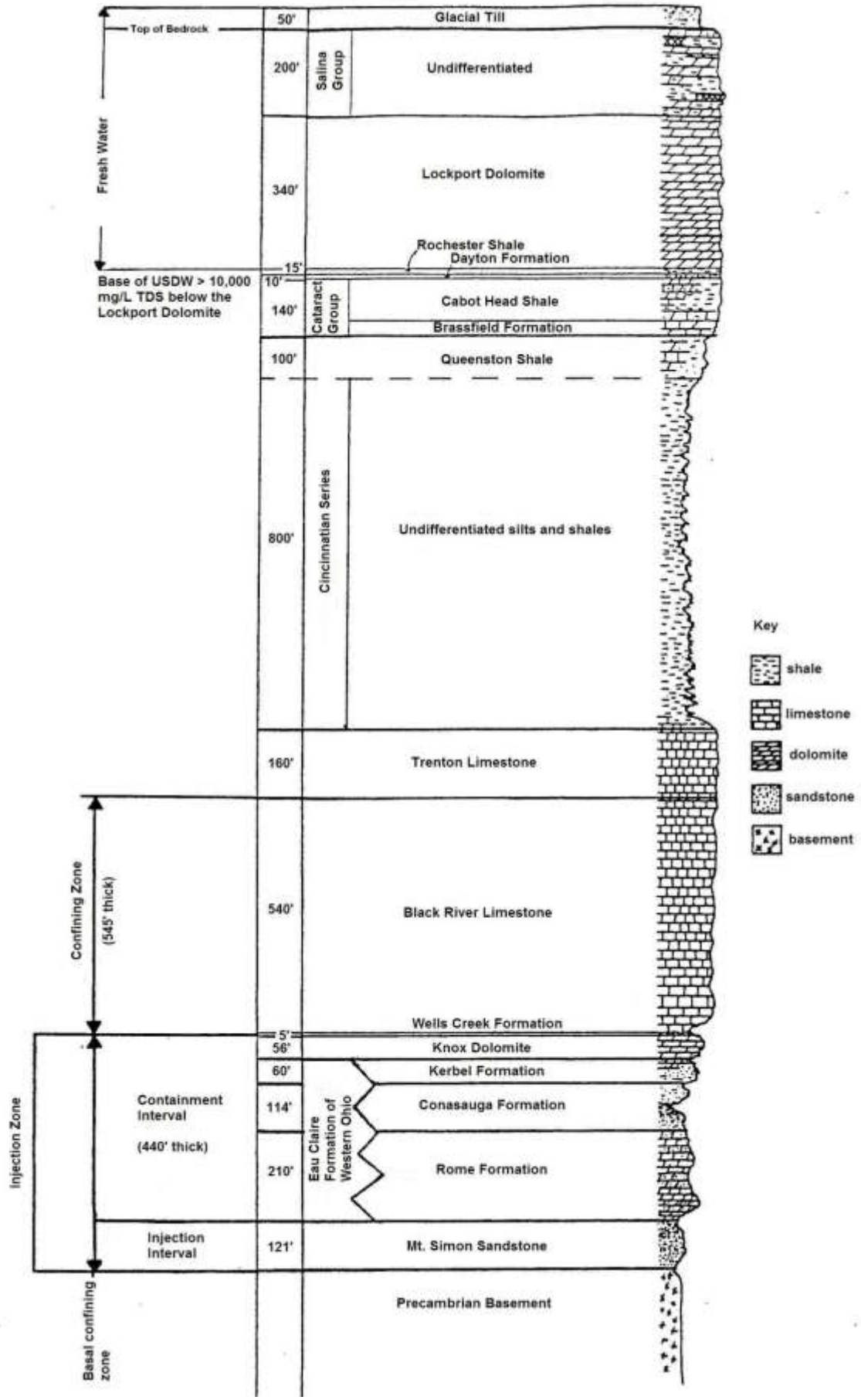

Figure 1. Generalized stratigraphic column of the VEI site. All depths in this figure are relative to the Kelly bushing which was eight feet above ground level when the well was drilled.

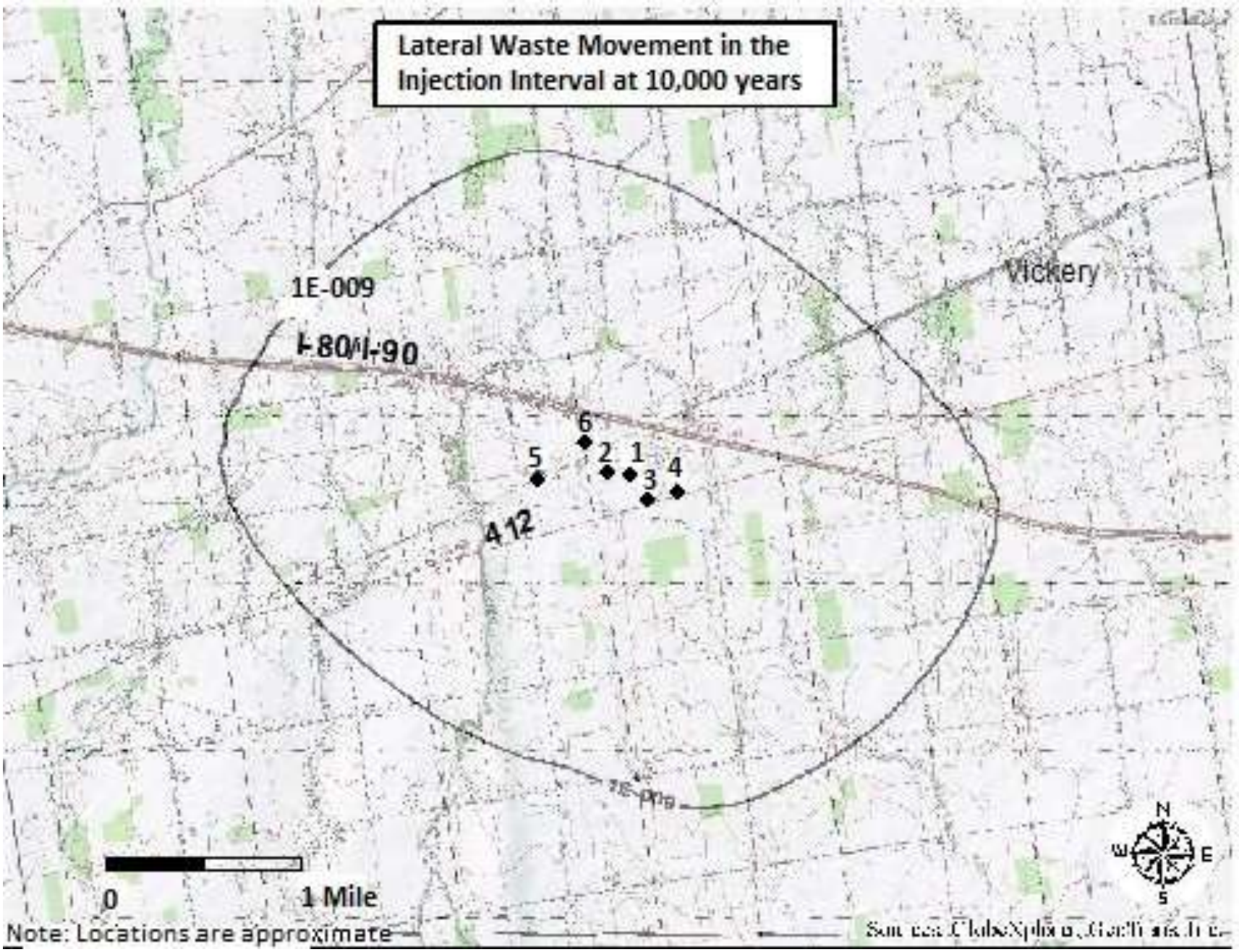

Figure 2. Lateral waste movement in the injection interval at 10,000 years.

EPA Plans to Renew Exemption for Hazardous Waste Wells

Vickery Environmental Inc.

Vickery, Ohio December 2014

The U.S. Environmental Protection Agency plans to approve a request from Vickery Environmental Inc. to continue injecting hazardous waste deep beneath the earth's surface. The Agency will consider public comments (*see box, left*) before making a final decision.

VEI has four injection wells at 3856 State Route 412, Vickery. VEI operates the wells under permits from the Ohio EPA. Those permits allow the company to dispose of liquid hazardous waste from a variety of sources.

The company also needs an exemption from the federal ban on underground disposal of hazardous waste. U.S. EPA makes decisions about these exemptions. EPA originally approved the exemption in 1990. If reissued the exemption will be valid until June 2027 based on the modeling done in 2007.

U.S. EPA found the company has shown – based on a reliable prediction – that injected waste will not move out of the injection zone within 10,000 years. The company has also shown that waste will not come into contact with any underground source of drinking water.

Background

Federal law prohibits the disposal of untreated hazardous waste on the land or into an injection well. The law allows U.S. EPA to grant exemptions. To qualify for an exemption, an owner or operator of an injection well must demonstrate, with a reasonable degree of certainty, that injected material will stay in the injection zone for as long as the waste is hazardous. That can be done by showing conditions at the injection site will prevent any movement of injected waste out of the injection zone in 10,000 years, and that conditions will prevent the possibility of waste contaminating any underground source of drinking water. This is known as a no-migration demonstration. VEI made an acceptable no-migration demonstration in its request that U.S. EPA reissue the 1990 exemption.

Technical information

VEI uses hazardous waste wells, which U.S. EPA calls Class I wells, to inject into a geologic interval composed of the Mt. Simon Sandstone. The top and bottom of the injection interval are 2,791 and 2,950 feet below

Comment period and public hearing scheduled

U.S. EPA is taking comments from the public on its plan to reissue an exemption from federal regulations for Vickery Environmental Inc. The public comment period ends **Tuesday, January 20.**

U.S. EPA will hold an open house from 6 to 7 p.m., followed by a formal public hearing from 7 to 8:30 p.m., on **Thursday, January 8:**

Townsend Township
Volunteer Fire Department
5076 County Road 247
Vickery

How to comment

You can comment during the public hearing or send written comments to:

Stephen Roy
U.S. EPA (WU-16J)
77 W. Jackson Blvd.
Chicago, IL 60604-3590
roy.stephen@epa.gov
FAX: 312-692-2951

For more information

To see the draft decision document, visit the Clyde Public Library Reference Desk, 222 W. Buckeye St. The full administrative record, including all data submitted by VEI, is at the EPA's regional office (address above). Contact Stephen Roy at 312-886-6556 for an appointment.

To learn about EPA's Underground Injection Control Program, visit www.epa.gov/r5water/uic.

You may call the EPA toll-free, 800-621-8431, Ext. 66556, weekdays, 9:30 a.m. to 5:30 p.m.

ground level, respectively. The deepest supply of drinking water in the area is approximately 574 feet below ground level, so there is approximately 2,217 feet of separation between the drinking water source and the injected hazardous waste. A containment interval is just above the injection interval. The top and bottom of the containment interval are 2,344 and 2,791 feet below the ground surface, respectively. The containment interval keeps the injected fluid in the injection zone because it contains low-permeability rock and does not have faults or fractures that could allow the fluid to move upward. The injection interval and the containment interval together are called the injection zone. A 544-foot thick confining zone lies above the injection zone. Extending laterally for hundreds of miles, the confining zone provides additional protection.

All injection wells have an "area of review." In this case, the area of review extends five miles around the well bore. If there are other wells in the area of review that are not properly plugged or abandoned, they could serve as a pathway for waste migration from the injection zone. VEI identified six wells within the area of review and showed these wells were properly plugged and abandoned. There are no known faults in the area of review that connect the injection interval with drinking water sources.

The VEI wells are permitted by Ohio EPA. Under the permits, the wells must pass an annual pressure test and a radioactive tracer survey to confirm the injected fluids are entering the injection interval and not moving up the well bore out of the injection zone. These tests demonstrate the mechanical integrity of a well's key components. The wells passed the annual pressure test and radioactive tracer survey performed between May and June of 2014.

Conditions of petition approval

The proposed reissuance of the exemption is subject to conditions. Failure to comply with the conditions is grounds for termination of the exemption. VEI must submit a petition for reissuance if it wants to modify any of the following conditions:

1. The exemption applies to the four existing hazardous waste injection wells at the VEI facility.

2. Injection of restricted hazardous waste is limited to the part of the Mt. Simon Sandstone at depths between 2,791 and 2,950 feet below the surface.

3. Only restricted wastes designated by the codes in Table 1 in the draft decision may be injected.

4. Maximum concentrations of chemicals allowed to be injected are listed in Table 2 in the draft decision.

5. The average specific gravity of the injected waste stream must be no less than 1.08 over a three-month period.

6. The cumulative volume of wastes injected into the wells must not exceed 10,368,000 gallons per month.

7. The exemption is approved for the 20-year modeled injection period, which ends on June 30, 2027. VEI may petition for a reissuance of the exemption beyond that date, provided the company gives U.S. EPA a new and complete petition and no-migration demonstration by Jan. 31, 2027.

8. VEI must submit a quarterly report to U.S. EPA containing an analysis of the injected waste and indicating the chemical and physical properties, including the concentrations, of all the injected chemicals listed in Table 2 in the draft decision.

9. VEI must submit to U.S. EPA an annual report containing the results of a bottom hole pressure survey (fall-off test) performed on one well each year. The survey must be performed according to 40 CFR § 146.68(e)(1). The annual report must demonstrate that the properties of the injection interval have not changed significantly since the exemption was granted.

10. VEI must annually submit to U.S. EPA the results of radioactive tracer surveys and annulus pressure tests for the wells. (The annulus is the area of the well that separates the inner tubing through which fluids are injected and the outer portion of the well.) These tests demonstrate whether the wells are working properly.

11. VEI shall notify U.S. EPA in writing if any well loses mechanical integrity and prior to any workover or plugging.

12. VEI must fully comply with all requirements set forth in underground injection control permits issued by Ohio EPA.

13. The exemption is subject to review upon the expiration, cancellation, reissuance, or modification of the Ohio EPA well permits.

14. Whenever U.S. EPA determines that the basis for approval of a petition under 40 CFR §§ 148.23 and 148.24 may no longer be valid, the Agency may terminate this exemption and require a new demonstration.