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COMMENTS - SOUTH FIELD INJECTION TEST FINAL REPORT

01/23/96

OEPA DOE-FN
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COMMENTS

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OhioEPA

State of Ohio Environmental Protection Agency

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George V. Voinovich
Governor

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January 23, 1996

RE: DOE FEMP
MSL 531-0297
HAMILTON COUNTY
COMMENTS: SOUTH FIELD INJECTION TEST FINAL REPORT

Mr. Johnny Reising
U.S. Department of Energy, Fernald Area Office
P.O. Box 538705
Cincinnati, OH 45253-8705

Dear Mr. Reising:

Please find as an attachment to this letter the Ohio Environmental Protection Agency's comments on the Draft South Field Injection Test Report received by this office on December 21, 1995.

The Ohio EPA considers it very important to pursue additional geochemical and hydrologic investigations that are necessary to resolve some of the complicated technical issues associated with reinjection of treated groundwater. A summary of the issues addressed in the attached comments follows:

- The possibility that contaminants may be drawn to lower parts of the GMA if excessively large vertical flow gradients result from reinjection into the upper portion of the aquifer.
- The possibility that iron precipitates will reversibly bind uranium and cause an increase in remediation time.
- The uncertainty of the relative importance of bacterial action compared to strictly geochemical action as causes of the plugging.
- The possible need for pretreatment of injected groundwater for dissolved solids and redox capacity should be evaluated.

If you have any questions, please contact Tom Ontko at (513) 285-6074 or me.

Sincerely,

Thomas A. Schneider
Fernald Project Manager
Office of Federal Facilities Oversight

cc: Jim Saric, U.S. EPA
Terry Hagen, FERMCO
Ruth Vandergrift, ODH
Mike Proffitt, DD&GW
Sharon McLellan, PRC
Manager, TPSS/DERR,CO
Dave Ward, GeoTrans

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OHIO EPA COMMENTS ON
THE SOUTHFIELD INJECTION TEST REPORT

1) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#:General Comment Pg.#: Line#: Code: C
Original Comment#
Comment: We concur that the results of the injection test indicate that injection can potentially be a viable supplement to extraction for the remediation of the GMA if the geochemical problems and limitations can be overcome. The work performed and interpretation provided are generally satisfactory.
Response:
Action:

2) Commenting Organization: Ohio EPA Commentor: DDAGW
Section #: 1.0 Pg #: Line #: Code:
Original Comment #:
Comment: Well/Bore logs for all observation, pumping, and injection wells should be included in the site wide data base. The updated file should then be sent to Ohio EPA.
Response:
Action:

3) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: 2.0 Pg.#: 2 Line#: 4 Code: C
Original Comment#
Comment: The report points out that geochemical issues are not in the scope of work for the injection test. The question arises as to where geochemical considerations are accounted for in the pump and treat system design and what sampling, if any, has been conducted relating to local geochemical conditions.
Response:
Action:

4) Commenting Organization: Ohio EPA Commentor: DDAGW
Section #: 2.3 Pg #: 5 Line #: 18 Code:
Original Comment #:
Comment: Why is 10 mg/L the cutoff concentration for concern?
Response:
Action:

5) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 2.3 Pg. #: 5 Line #: 25 Code: E
Original Comment #

Comment: An explanation of the TDS of the injected water (ranging between 2 and 12 mg/l, Table 4-1) and the formation water (ranging between 2 and 2802 mg/l, Tables 6-6 through 6-11) should be provided.
Response:
Action:

7) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 2.3 Pg. #: 6 Line #: 5 Code: C
Original Comment #
Comment: Was chlorine considered or measured?
Response:
Action:

8) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 4 Pg. #: Figure 4-6 and D-1 Line #: Code: C
Original Comment #
Comment: Is there an explanation as to why the water level in well 2387 rose 0.9 ft in response to 3.45 inches of rainfall and the other wells typically rose 0.1 to 0.24 feet?
Response:
Action:

9) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 4.1 Pg. #: 12 Line #: 2 Code: C
Original Comment #
Comment: While we agree that well 31550 is suitable for the purposes of the injection test, the screened interval (upper 30%) of the saturated GMA may not be ideal placement vertically for injection. In fact, the increased head may cause significant downward gradients which may be detrimental of the recovery operations, causing the chemicals to plunge deeper into the formation. There needs to be supporting calculations to demonstrate that the hydraulic efficiency will actually increase with reinjection at 31550.
Response:
Action:

10) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 4.1 Pg. #: 12 Line #: 14 Code: C
Original Comment #

Comment: All of the well screens are essentially at the same elevation. It should be noted that this precludes the interpretation of the vertical hydraulic response.
Response:
Action:

11) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 4.1 Pg. #: 12 Line #: 15 Code: C
Original Comment #
Comment: In wells 31550-in and 31550-out, the maximum head increase for the step tests are 9.69 and 7.447 feet and in the constant test are 25.7 and 29.18 feet. Given that the transducer range is 20 psi, or 46 feet of head, this choice of transducer appears to be appropriate.

In the other observation wells (31551, 31552, 31553, 31554, 31555, 31556), the head increase is generally less than 1 foot. In hindsight a 5-psi transducer may have been a more appropriate choice. While Insitu offer 10 and 20-psi instruments, other manufacturers such as Instrument Northwest offer 5 psi and less. A 5-psi transducer would provide a range of 11.5 feet which should be sufficient including the submergence depth.

The accuracy of the 20-psi equipment (Insitu PXD-260) is +/- 0.15% or the range at constant temperature and +/- 0.05% using the Hermit 2000 logger. This corresponds to an accuracy range of +/- 0.023 to +/- 0.069 feet. (Data obtained from product specification sheet on file). This can be significant for the constant rate test. It is unclear how greater accuracy was obtained as shown in Figures 6-4 through 6-5. The accuracy of the equipment should be documented because the figure implies a much greater accuracy. The resolution of the Insitu PXD-260 should be provided.
Response:
Action:

12) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 4.2 Pg. #: 13 Line #: 13 Code: E
Original Comment #
Comment: A reference to Appendix D for slug test data should be provided.
Response:
Action:

13) Commenting Organization: OEPA Commentor: GeoTrans, Inc.

Section#: 5.1 Pg.#:14-16 Line#: Code: C
Original Comment#
Comment: Was the transducer inside the pumping well isolated from turbulence by a standpipe?
Response:
Action:

14) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 5 Pg. #: Table 5-1 Line #: Code: E
Original Comment #
Comment: In step 2 at 0.7 minutes the table reads 521.009 and should read 521.090.
Response:
Action:

15) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 5 Pg. #: Table 5-1 Line #: Code: E
Original Comment #
Comment: In step 3 at 10.0 minutes the table reads 588.268 and should read 528.268.
Response:
Action:

16) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 5 Pg. #: Table 5-1 Line #: Code: E
Original Comment #
Comment: In step 2 at 0.0 minutes the table reads 519.954 and should read 518.954.
Response:
Action:

17) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 5 Pg. #: Table 5-1 Line #: Code: E
Original Comment #
Comment: The water level at time zero is not clear. In step 1, the reference pressures are used in steps 2 and 3. It is not clear as to how these were derived from tables A-2 through A-4.
Response:
Action:

18) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 5 Pg. #: Table B-2 Line #: Code: C

Original Comment #
Comment: There are several instances of unexplained data, such as the value of 22 degrees C water and DO of 8.7 on 10/9. Are these data errors? Were these values checked? An explanation needs to be provided.
Response:
Action:

19) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: Table 5.3 Pg.#: Line#: Code: C
Original Comment#
Comment: Reorganizing Table 5.3 to separate the current injectivity data and previous pump test injectivity data would improve data clarity. Due to the differences in pumping rates, the current presentation of results could be misinterpreted.
Response:
Action:

20) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 5.4 Pg. #: 16 Line #: 17 Code: E
Original Comment #
Comment: The specific injectivity should read 46.4, not 46.44.
Response:
Action:

21) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 5 Pg. #: Figure 5-4 Line #: Code: E
Original Comment #
Comment: (1) The initial (10/12) redox of 483 mV for well 31550 is not shown on Figure 5-4. From Table B-1, the values range from 310 to 340.

(2) Between 10/7 and 10/11, the report should explain why the redox increased from 310 to 500 and the DO decreased from 5.5 to 2.2.
Response:
Action:

22) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 5 Pg. #: Figure 5-5 Line #: Code: E
Original Comment #
Comment: The initial (10/12) DO of 2.07 mg/l for well 31550 is not shown on Figure 5-5.
Response:

Action:

23) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 5 Pg. #: Figure 5-5 Line #: Code: E
Original Comment #
Comment: All of the data should be included on Figure 5-5. Specifically, the late time portion for well 31555 and all of the data for 31552 and 31553.
Response:
Action:

24) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 6.1 Pg. #: 18 Line #: 4-7 Code: C
Original Comment #
Comment: The average rate of water level decline during the pretest period is reported as 0.020 ft/day. The data from Appendix D were independently analyzed and summarized in the following table.

Well Number	**Rise in water level (ft, interpreted from Figures D-1 to D-5)**		**Average rate of decline (ft/day) (Interpreted from Figures D-1 to D-5)**	**Mound after 2000 minutes (taken from Fig 6-13)**
	10/3-10/5	**10/14-10/15**		
2387	.12	.90	0.0257	.65
2049	.24	.24	0.0234	.85
2390	.45	.10	0.0271	.03
2434	.21	.20	0.0308	.076
2398	.20	.12	0.0300	.03

From these interpretations, the average water level decline rate is 0.0274 ft/day. This would result in a maximum water level correction after 4,000 minutes (2.77 days on Table 6-4) of 0.076 ft rather than the 0.056 used in Table 6-4.

Response:
Action:

25) Commenting Organization: Ohio EPA Commentor: DDAGW
Section #: 6.1 Pg #: 19 Line #: 1-15 Code:
Original Comment #:
Comment: This effect is not clear. If biological growth and iron precipitation result in clogging the injection well screen, then the rate that water leaves the well and enters the aquifer is decreased; thus causing the water level in the injection well to rise. If the rate that water enters the aquifer is decreased, the water levels should either decrease or the rate of increase should slow down in the surrounding observation wells.
Response:
Action:

26) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 6 Pg. #: Tables 6-5 through 6-11 Line #: Code: E
Original Comment #
Comment: On 10/12, these tables show a significantly higher temperature (15 to 17 deg C) as compared to the measurements in Appendix B. The tables are from water samples collected and analyzed either in the field or nearby lab. Values presented in the appendix are from downhole probe measurements. Because the daily temperature at the site on 10/12 ranged from 80 deg F to 39 deg F, it is reasonable that water sampled were warmed to 62 deg F (17 deg C) from the downhole conditions of 52 deg F (11 deg C). The measurement conditions should be noted in the appropriate tables in Section 6.
Response:
Action:

27) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 6 Pg. #: Figure 6-12 Line #: Code: E
Original Comment #
Comment: The note indicates that the high DO is temporary and corresponds to sampling events. It should be noted in the report that not all data is plotted in this figure. This still does not explain the elevated levels of DO such as 10.41 in Table B-11, P. 8 of 13 at 194000 on 10/15 in well 31551. This well was sampled at 20:15 on 10/15 (Table 6-6). It would appear as though the time reported on Table 6-6 is when the readings were made and not when the samples were collected. If this is the case, a note should be added to the table to indicate that the samples were collected previously, typically within the previous 10 to 60 minute period.
Response:
Action:

28) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: 7 Pg.#:23-25 Line#: Code: C
Original Comment#
Comment: Two of the data sets were selected for review because of the obvious different conditions encountered before and after the 72-hour injection test. Both the "PREVAC1" and "POSTVAC2" data were analyzed with both the Bouwer and Rice (1976) and Cooper et al (1967) methods using AQUESOLV™. Both methods yielded similar results to those presented in the report. The Bouwer and Rice analysis of the "PREVAC1" data yielded a hydraulic conductivity value of 257.2 ft/day, slightly higher then the 241.5 ft/day value reported. The Cooper et al (1967) analysis of the PREVAC1 data yielded a hydraulic conductivity of 260.2 ft/day. The results of Bouwer and Rice (1976) and Cooper et al. (1967) analysis of the "POSTVAC2" data set yielded values of 46.5 ft/d and 27.21 ft/d respectively, again comparable to the 37.3 ft/day value reported. Thus the reviewers concur with reported data interpretation.

References

Bouwer, H. and R. C. Rice, 1976. A slug test for determining hydraulic conductivity of unconfined aquifers with completely of partially penetrating wells. Water Resources Research, v. 12, n. 3, pp 423 - 428.

Cooper, H. H. jr., and J.D. Bredehoeft and S.S. Papadopulos. 1967. Response of a finite-diameter well to an instantaneous charge of water. Water Resources Research, v. 3, n. 1, pp 263 - 269.

Response:
Action:

29) Commenting Organization: Ohio EPA Commentor: DDAGW
Section #: 8.1 Pg #: 26 Line #: Code:
Original Comment #:
Comment: The water chemistry issue should not be trivialized. A process which can reduce hydraulic conductivity 84% within 72 hours is going to have a tremendous impact on a system that is designed to pump over 5.7 million gallons per day for 10 years. The results of this test show that unless DOE can come up with a method of eliminating iron precipitation and controlling biological action, injection cannot be considered a viable option for augmenting ground water remediation.
Response:
Action:

30) Commenting Organization: Ohio EPA Commentor: DDAGW
Section #: 8.1 Pg #: 27 Line #: Code:
Original Comment #:
Comment: Was there any injection rate data which could be salvaged to calculate hydraulic conductivity? If the biological action was increasing exponentially at the end of the test, can earlier results be used?
Response:
Action:

31) Commenting Organization: Ohio EPA Commentor: DDAGW
Section #: 8.1 Pg #: 28 Line #: 1-2 Code:
Original Comment #:
Comment: Please quantify "close".
Response:
Action:

32) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: 6.3/8.1 Pg.#:20-21,26-27 Line#: Code: C
Original Comment#
Comment: There is little evidence to support the notion that *Gallionella* iron bacteria would not continue to be a problem if more oxidizing water is used in the next injection test. While it is reasonable to assume the changes in Eh during the reinjection test contributed to *Gallionella* bacterial growth, this does not support and address other factors such as ferric hydroxide precipitation, velocity-induced pressure changes and other natural geochemical reactions. It is agreed that further testing is required to examine the iron precipitation problem.
Response:
Action:

33) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: 8.2 Pg.#: 28 Line#: 13-17 Code: C
Original Comment#
Comment: The current level of sampling is not adequate to support geochemical modeling of precipitation of iron hydroxide in the Great Miami Aquifer.

Response:
Action:

34) Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: Appendix A & E Pg.#: Line#: Code: C
Original Comment#
Comment: The data presented in Appendix E have been reviewed, the details of how the raw data were adjusted and transformed are not presented. The normal format of transducer data is "time of day" and "height of water above the transducer". Data presented in Appendix A indicates that the recorded transducer data could be modified to yield the elevation of the water table based on some measuring point. At some point during the test the value recorded by the data logger is equal to the height of water above the transducer and the amount of pressure or vacuum applied to the well to achieve the desire displacement. It is not clear from the report how the results were modified or what information was used to create the data sets provided. An explanation of what methods were used is necessary as the amount of head increase induced in the well does not correspond to any value presented in the report (10 feet). Instead each data set starts when time and displacement equal zero. For example, for "PREVAC1" the maximum amount of displacement is 7.816 ft, 1.8 seconds into the test. Similar conditions are shown in "POSTVAC2".
Response:
Action: