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January 27, 2003

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

RE: COMMENTS REVISED TEST PLAN FOR IN SITU STABILIZATION THRU EARP

Dear Mr. Reising:

This letter provides Ohio Environmental Protection Agency comments on the Revised Test Plan for In Situ Chemical Stabilization of Metals and Radionuclides Through Enhanced Anaerobic Reductive Precipitation.

Should you have any questions, please contact Tom Ontko or me.

Sincerely,

for Tom Ontko

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

cc: Jim Saric, U.S. EPA
Terry Hagen, Fluor Fernald
Mark Shupe, GeoTrans, Inc.
Michelle Cullerton, Tetra Tech EM Inc.
Ruth Vandergrift, ODH

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Ohio Environmental Protection Agency Comments on the Revised Test Plan for *In Situ* Chemical Stabilization of Metals and Radionuclides through Enhanced Anaerobic Reductive Precipitation

1) Commenting Organization: Ohio EPA Commentor: OFFO
Section #: Pg #: Line #: Code: general
Comment: The baseline technology for the remediation of the Great Miami Aquifer (pump and treat followed by re-injection) has proven successful in reducing the greater-than 30 ppb total uranium plume. Total mass of uranium removed also indicates that the baseline technology is making good progress in achieving the remedial goals. The Ohio EPA greats this new technology with scepticism considering the success of our baseline technology and the reservations expressed below about the new technology.

2) Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: NA Pg.#: NA Line #: NA Code: general
Comment: The text states an important feature of the in-situ precipitation is its irreversibility. The reverse dissolution does occur. For example, elevated uranium concentrations occur naturally in groundwater in geologic formations containing uranium ore deposits. The key for a successful application of the technology is the understanding and characterization of dissolution kinetics for uranium or other metal precipitants. The phase diagrams illustrate the theoretical potential for the occurrence of precipitation as well as dissolution, depending on environmental conditions (e.g., Eh, pH). It is the dissolution kinetics that will dictate applicability of the EARP technology. As proposed, one of the two success criteria is that the expected dissolution time for 90 percent of the constitute of concern should be at least five times longer than the half life of the nuclide. To assess if the IRZ/EARP technology will meet this success criterion for uranium, the relevant dissolution kinetic constants need to be established. The testing plan as currently designed will not, in our view, generate data for accurate determination of these parameters.

) Commenting Organization: Ohio EPA Commentor: OFFO
Section #: NA Pg #: NA Line #: NA Code: general
Comment: Increases in redox potential have been observed in areas that are under the influence of surface water, namely in the area of surface water drainages along Willey Road. We note that the restoration of the south field will allow Paddy's Run Creek to overflow to the north of its low-flow banks and that some existing low areas are designed to function as infiltration galleries to increase the hydraulic gradient. In the longer term, it is possible that Paddy's Run will leave its current channel and develop a new course through the South Field and thereby increase the redox potential in the South Field.

4) Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 1.2 Pg.#: 4 Line #: 18 Code: C
Comment: The text states that the conditions created by EARP are sufficient to reduce ferric iron, which is usually present in most aerobic geochemical systems, to ferrous. If the condition is such that ferric iron (Fe3+) is readily reduced to ferrous (Fe2+), then it is not

kinetically supportive of the proposed chromium reduction from Cr(VI) to Cr(III). This is because the proposed chemical reaction requires the ferrous iron to be oxidized to ferric. This would not happen under the reductive environment created by the EARP technology.

5) Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 1.2 Pg.#: 4 Line #: 18 Code: C
Comment: In the strong reductive environment created by the use of EARP, chromium can be reduced and immobilized in the soil matrix. At same time, however, other hazardous heavy metals such as arsenic can become soluble and mobile in groundwater. (See William J. Deutsch, Groundwater Geochemistry, Lewis Publishers, page 175) Reductive arsenic, for example, can enter groundwater from waste materials or natural formation materials when present in high levels. Therefore, it is recommended that the evaluation include consideration of potential effects on other metals in the groundwater geochemical system. Caution needs to be exercised to avoid the inadvertent creation of unwanted secondary contamination as the by-product of the EARP application.

6) Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 1.2 Pg.#: 5 Line #: 11 Code: C
Comment: The cited principle is based on the kinetic argument that in the EARP-induced reductive environment, MnO_2 is in solid phase and has low concentration in groundwater. As such, the MnO_2-induced chromium dissolution reaction is unfavorable kinetically in post-remediation period.
After remediation, when molasses introduction to groundwater is ceased and groundwater has recovered to its pre-treatment more oxidative state, MnO_2 mobility will be increased. MnO_2 chemical mobility under the new environment should be investigated. Chromium solubility under these conditions may actually be increased.

7) Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 1.4 Pg.#: 6 Line #: 30 Code: C
Comment: The text proposes that uranium precipitates from groundwater in the form of UO_2 and is present as impurities and inclusions of co-precipitated FeS. It is then stated that this will reduce the potential of UO_2 dissolution back into groundwater in the post-remediation period. It is recommended that further studies of this mechanism be undertaken through SEM and DRF studies of precipitants. The proposed study does not appear to adequately investigate this mechanism or to evaluate the potential of uranium re-dissolution into the groundwater.

8) Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 1.5 Pg.#: 10 Line #: 23 Code: C
Comment: The statement regarding the uranium concentration in that the earth's crust is irrelevant and misleading. Granites and uranium ores do release uranium into

environments during the weathering process. This observation is well documented in geological literature and is the principle upon which several methods in geochemical mineral exploration are based.

Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 1.5 Pg.#: 10 Line #: 23 Code: C
Comment: It is not clear that the proposed experimental design in will provide information sufficient for determining the dissolution kinetic constant needed for determination of the indicated success criteria (e.g., future environmental concentrations will be 30 percent of the proposed regulatory limit and 10 percent of the pretreatment value and the time required for 90 percent of the dissolution is at least 5 times the nuclide half-life). For example, the experimental duration may not be long enough for meaningful scientific determination when the South Field groundwater without any compositional modification is used as the source water for testing.

0) Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 4.1 Pg.#: 17 Line #: 17 Code: C
Comment: Would repacking the columns result in an artificially high porosity? It would seem advantageous to the study to keep the core in tact, given that the rotosonic drilling procedure produces very accurate core samples in large volume.

1) Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 4.2.5 Pg.#:21 Line #: 2 Code: C
Comment: The purpose of soil testing is apparently to examine the changes, if any, of uranium concentrations in the column as the result of chemical fixation induced by the technology. However, it is likely that the amount of uranium transferred from the water to the column will be minimal. A 90 percent reduction of uranium concentration in groundwater after numerous pore flushings would result in the precipitation of 7.3E-5 kg uranium in the 12.2 kg of soil in the column. This result is based on the maximum South Plume uranium concentration (600 ug/L). Even if the column is 100 percent efficient, the uranium concentration change in the soil is less than 6 ppm. Please check the detection limit, accuracy, and precision of uranium analysis for the proposed 6020 ICPMS method. These should be compared to the predicted concentration changes to ensure adequate analytical sensitivity and accuracy of experimental data used to determine the degree of chemical fixation achieved.

2) Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 4.2.3 Pg.#: 19 Line #: 12 Code: C
Comment: The experimental design is not an analog of the natural groundwater system at the site. For example, the groundwater samples were not obtained in-situ with the aquifer material. No attempt is made to reproduce the natural equilibrium/disequilibrium

condition of the system in the field. As a result, flow entering the columns may have a different composition from the exiting flows. The proposed experimental design, however, assumes column inflow and outflow are chemically identical when groundwater is recycled through the columns.

Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 4.2.3 Pg.#: 19 Line #: 35 Code: C
Comment: The proposal does not address the control of experimental conditions such as DO and ORP of the test groundwater samples. The DO level and other conditions of the groundwater collected from the site should remain unchanged during month-long testing period. Similarly, no change should occur in the process of water recirculation. Please clarify how these parameters will be maintained in the experiment.

Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 4.2.5 Pg.#: 21 Line #: 2 Code: C
comment: The text indicates that soil samples will be taken at the end of testing for analysis of COC concentrations. These concentrations will be compared with the concentrations before testing. However, any concentration changes may reflect the combined results of both chemical fixation and post-remediation dissolution processes. How will the contributions from each process be determined?

Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 4.2.4 Pg.#: 20 Line #: 27 Code: C
Comment: One of the objectives stated in Section 3.0 is to evaluate the potential for colloidal transport. Will colloid concentrations and characteristics be determined in any of the 19 liquid samples that are planned?

Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 4.2.6 Pg.#: 21 Line #: 7 Code: C
Comment: It is unclear how the data obtained from the experiment and the data analysis approach discussed will provide an estimate of the dissolution kinetics constant needed for evaluating the technology against the success criteria.

Commenting Organization: Ohio EPA Commentor: OFFO
Section #: 4.2.6 Pg #: 21 Line #: Code: c
Comment: The data analysis should include a discussion and comparison of the redox potential as measured in the apparatus and as calculated using the Nernst equation for the nitrate/ammonia couple and the sulfate/sulfide couple. These species may prove useful in assessing the redox potential of the aquifer.