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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

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REPLY TO THE ATTENTION OF: SRF-5J

Mr. Johnny W. Reising
United States Department of Energy
Feed Materials Production Center
P.O. Box 398705
Cincinnati, Ohio 45239-8705

Subject: **Technical Review Comments on "Comparability of Total Uranium Data as Measured by In-Situ Gamma Spectrometry and Four Laboratory Methods"**

Dear Mr. Reising:

The United States Environmental Protection Agency (U.S. EPA) has reviewed the above-referenced document as part of its oversight activities for the Fernald Environmental Management Project. The document, dated September 1997 and is an addendum to the July 1997 "Comparability of In-Situ Gamma Spectrometry and Laboratory Data," was prepared by Fluor Daniel Fernald for the U.S. Department of Energy.

The addendum compares high-purity germanium (HPGe) detector measurements to laboratory (1) gamma spectrometry data, (2) bromoPADAP data, (3) inductively coupled plasma/mass spectrometry data, and (4) alpha spectrometry data that is discussed in the July 1997 comparability study. In addition, the addendum compares HPGe detector measurements and laboratory results generated using these four analytical methods that reflect total uranium concentrations near or exceeding 1,000 parts per million in order to assess use of the HPGe detector for evaluation of waste acceptance criteria attainment.

The U.S. EPA review of the addendum focused on its technical adequacy to support use of in situ gamma spectrometry as a standard method for decision-making during soil remediation activities and revealed some issues that require clarification. U.S. EPA's general and specific review comments are enclosed.

Please contact me at (312) 886-4591 if you have any questions.

Sincerely,

E Jablonowski

Gene Jablonowski
Remedial Project Manager
Federal Facilities Section
SFD Remedial Response Branch #2

Enclosure

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cc: Tom Schneider, OEPA-SWDO
Bill Murphie, U.S. DOE-HDQ
John Bradburne, FERMCO
Terry Hagen, FERMCO
Tom Walsh, FERMCO

ENCLOSURE

TECHNICAL REVIEW COMMENTS ON
"COMPARABILITY OF TOTAL URANIUM DATA AS MEASURED BY IN-SITU GAMMA SPECTROMETRY AND FOUR LABORATORY METHODS"

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

(Four Pages)

TECHNICAL REVIEW COMMENTS ON
"COMPARABILITY OF TOTAL URANIUM DATA AS MEASURED BY IN-SITU GAMMA SPECTROMETRY AND FOUR LABORATORY METHODS"

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

GENERAL COMMENTS

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Not Applicable (NA) Page #: NA Line #: NA
Original General Comment #: 1
Comment: In general, the document provides an adequate exploratory data analysis of the results generated using in situ gamma spectrometry and four laboratory methods: (1) gamma spectrometry, (2) bromoPADAP, (3) inductively coupled plasma/mass spectrometry, and (4) alpha spectrometry. However, hypothesis testing is needed to support the conclusions drawn from the figures and tables in the document and to help generate additional information from the data. For instance, an analysis of variance and a multiple comparisons test could be applied to the laboratory results for each of the areas addressed in the Appendix A tables; the results of such statistical analysis and testing would provide useful information on the comparability of the four laboratory methods.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: NA Page #: NA Line #: NA
Original General Comment #: 2
Comment #: The text presents a general comparison of high-purity germanium (HPGe) detector measurement and the four laboratory methods. However, further discussion of outliers and known activity levels should be included.

During review of the HPGe detector data, three significant outliers were noted that appear to indicate detector limitations. The first and largest outlier is associated with area PBC-03. In this case, the HPGe detector measurement indicates a very low bias for detecting uranium that existed in a hot spot. Furthermore, this hot spot appeared to be located directly below the HPGe detector face, where it should have had the greatest detection probability. Although the July 1997 comparability study provides reasons for this discrepancy, the HPGe detector may not be adequate to accurately define hot spots in a highly heterogenous environment. The text should be revised to address this issue.



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The second outlier pertains to the duplicate HPGe detector measurements taken 1 meter above the ground surface in area PBC-01. In this case, the first HPGe detector measurement indicated a uranium concentration of 0.06 part per million (ppm), whereas the second measurement indicated a uranium concentration of 7.97 ppm. Subsequently the first data point was omitted. If the HPGe measurements had been averaged for this area as was done for other areas, this area would have generated another low-bias indication for the HPGe detector. The text should be revised to justify the omission of the first data point.

The third outlier is associated with HPGe detector measurement of area PBC-07 from 1 meter above the ground surface. Once again, the HPGe detector appeared to bias the uranium detection low. However, the reason for this discrepancy is not clearly stated in the text. In this instance, the average of the total uranium results derived using the four analytical methods is used to demonstrate comparability with the HPGe detector total uranium results in Table 2E, but it is not clear why all the 1-meter HPGe detector measurements are at least 20 percent lower than the laboratory analytical measurements. Regarding the percent relative deviation between the results derived from the four analytical methods, the largest difference exists between the alpha spectrometry and gamma spectrometry results: a percent relative deviation of 8.8 percent. Because the HPGe detector measurements demonstrate a percent relative deviation of 25.5 percent from the average of the total uranium results derived from the analytical methods, an argument could be made that HPGe detector measurement is not comparable to the laboratory methods. The text should be revised to address this issue.

Ideally, in comparing HPGe detector measurement to analytical methods, known standards should be used as a baseline; in doing so, percent relative deviations would give more accurate indications of the closeness of laboratory results and HPGe detector results to true values. The possibility of developing such standards for the HPGe detector and the laboratory methods should be further evaluated.

## SPECIFIC COMMENTS

Commenting Organization: U.S. EPA Commentor: Saric
Section #: NA Page #: 2 Line #: 30
Original Specific Comment #: 1
Comment: The text states that all data are presented on a wet-weight basis. This practice is acceptable because all the

soil samples from a given area were collected at the same time, so they have similar moisture content. However, other studies have shown that measurements presented on a dry-weight basis, the standard for the final remediation level and other regulatory purposes, are also more reproducible. Therefore, data should be presented on a dry-weight basis in the document. Furthermore, measurements presented on a dry-weight basis should be used if the data in this document are combined with other data in a document of wider scope.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: NA Page #: 3 Line #: 5 through 8
Original Specific Comment #: 2
Comment: The text states that total percent uncertainty (TPU) is displayed for each analytical method. However, only counting errors were considered in determining the uncertainties associated with the HPGe detector. Because counting uncertainties and systematic errors were used to estimate the total propagated error, the TPU for the HPGe detector is incomplete and should be further developed. The text should be revised to address this issue.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Table 1A Page #: NA Line #: NA
Original Specific Comment #: 3
Comment: In Table 1A and in most other tables, summary statistics for area PBC-03 are listed twice, with and without data for sample PBC-03-01 included. The rationale for excluding the data for this sample should be summarized in the accompanying text, and a reference to the full discussion of this matter in the July 1997 comparability study should be included in the summary.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: NA Page #: 7 Line #: 5
Original Specific Comment #: 4
Comment: The text states that the data collected by the HPGe detector from 31 centimeters above the ground surface show very good linear regression characteristics: the slopes are near unity and the intercepts are near zero based on use of the spreadsheet functions. However, a more sophisticated statistical program should be used to test the hypotheses that the slopes and intercepts are not significantly different from their ideal values.

Commenting Organization: U.S. EPA Commentor: Saric
Appendix #: B Page #: B-2 Line #: NA
Original Specific Comment #: 5
Comment: The text discusses the characteristics of the inductively coupled plasma/mass spectrometry analytical method. The text should note that the only interferences



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that occur in this method involve other acid-stable, arc-stable inorganic species with the same mass-to-charge ratios as the target species. Most such interferents, such as plutonium-238 and neptunium-235, are rare and unstable, so the method is generally quite isotope-specific.