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Department of Energy

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1 2 FEB 2002

Mr. James A. Saric, Remedial Project Manager
United States Environmental Protection Agency
Region V, SRF-5J
77 West Jackson Boulevard
Chicago, IL 60604-3590

DOE-0310-02

Mr. Tom Schneider, Project Manager
Ohio Environmental Protection Agency
401 East 5th Street
Dayton, OH 45402-2911

Dear Mr. Saric and Mr. Schneider:

TRANSMITTAL OF EXCAVATION MONITORING SYSTEM DOCUMENTATION AND RESPONSES TO THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY AND OHIO ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON THE AREA 3A/4A EXCAVATION CHARACTERIZATION AND PRE-CERTIFICATION PROJECT SPECIFIC PLAN

The purpose of this letter is to transmit, for your review and approval, responses to the United States Environmental Protection Agency and Ohio Environmental Protection Agency comments that were received on the Project Specific Plan (PSP) for the excavation characterization and pre-certification activities in Area 3A/4A. If acceptable, upon your verbal approval of these draft comment responses, the revised PSP will be submitted for your final review and approval.

Included with and supporting these comment responses are documents supporting the deployment of the Excavation Monitoring System (EMS) into the Real-Time Instrumentation Measurements Program. Specifically, the following documents and reports are included:

(1) draft EMS Report, "Development and Deployment of the Excavation Monitoring System (EMS),"

(2) Update to the Real-Time User's Manual incorporating the EMS instrument,

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Mr. James A. Saric -2-
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(3) Completed Acceptance Testing Plan for the EMS, and

(4) Validation Report: Volatile Organic Analyses Using the Voyager Field Portable Gas Chromatograph Via Method 6549.0 "Analysis of Volatile Organic Compounds in Field Samples by Manual Headspace Using a Field Portable Gas Chromatograph," dated October 2001.

The draft EMS Report describes the EMS instrument and the types of measurements that can be made with it, its uses and applications, and its strengths and limitations. The EMS is a second-generation device that has been fabricated specifically to support characterization of soils in the deep and complex excavations of the former production area. Although the EMS is a new instrument on a new and unique platform of an excavator, it behaves in many ways like the other sodium iodide (NaI) instruments, but with several advantages. The ultrasonic sensors and the laser range finder provide the necessary, real-time feedback to the cab operator to allow a steady and consistent sweep of the excavator arm and, hence, scan for gamma ray activity. With these sensors and the detector suspended in the air via the excavator arm, more consistent surveys can be made with the EMS as compared to the undulations that occur to the detector when mounted on a wheel-based platform. Also with the EMS, the detector, whether it be the NaI or the Hyper Pure Germanium (HPGe), is suspended out away from the excavator and is, therefore, not constrained by any shielding effects from the platform itself (unlike the other NaI platforms which tend to interfere with the gamma photons).

The validation report to support the use of the field portable gas chromatograph for quick turn-around of volatile organic analyses (item #4 above) is enclosed. The validation report provides the requested information concerning the precision and accuracy of this field instrument.

If you should have any questions or comments, please give Robert Janke a call at (513) 648-3124.

Sincerely,

Johnny W. Reising
Fernald Remedial Action
Project Manager

FEMP:R.J. Janke

Enclosures: As Stated

cc w/enclosures:
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N. Hallein, EM-31/CLOV
R. J. Janke, OH/FEMP
T. Schneider, OEPA-Dayton (three copies of enclosures)
G. Jablonowski, USEPA-V, SRF-5J
F. Bell, ATSDR
F. Hodge, Tetra Tech
M. Schupe, HSI GeoTrans
R. Vandegrift, ODH
R. Abitz, Fluor Fernald, Inc./MS64
R. Danahy, Fluor Fernald, Inc./MS52-4
B. McDaniel, Fluor Fernald, Inc./MS50
F. Miller, Fluor Fernald, Inc./MS64
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T. Hagen, Fluor Fernald, Inc./MS65-2
S. Hinnefeld, Fluor Fernald, Inc./MS52-2
T. Walsh, Fluor Fernald, Inc./MS46
ECDC, Fluor Fernald, Inc./MS52-7

RESPONSES TO U.S. ENVIRONMENTAL PROTECTION AGENCY TECHNICAL REVIEW COMMENTS ON THE DRAFT PROJECT SPECIFIC PLAN FOR AREA 3A/4A EXCAVATION CHARACTERIZATION AND PRECERTIFICATION (20200-PSP-0009, REVISION A)

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

GENERAL COMMENT

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Not Applicable (NA) Page #: NA Line #: NA
Original General Comment #: 1

Comment: The project specific plan (PSP) discusses three new surveying techniques to be implemented during excavation and precertification activities in Area 3A/4A. These techniques include use of an excavation monitoring system (EMS) to determine radionuclide levels, a photoionization detector (PID) to screen for volatile organic compounds (VOC), and a field gas chromatograph (GC) to provide more definitive data on VOC concentrations. However, documentation regarding the EMS specifications and calibration, the action levels for the PID, and the precision and accuracy of the field GC has not been provided to the regulatory agencies for review. As discussed in the specific comments below, detailed information regarding the use of the three instruments will have to be reviewed and approved by the regulatory agencies before the instruments are used for excavation characterization and precertification.

Response: Included with these comment responses is the draft Excavation Monitoring System (EMS) Report. The draft EMS Report describes the types of measurements that can be made with this new, real-time instrument, its uses and applications, and its strengths and limitations. Included also in the report is the calibration information and data for the EMS. The EMS Report provides an overview and general guidance for the device. Also included with these responses is the completed Acceptance Testing Plan on the EMS. The acceptance testing on the EMS was completed the week of December 4, 2001. Other guidance associated with the EMS use includes the User Guidelines, Measurement Strategies, and Operational Factors for Deployment of *In Situ* Gamma Spectrometry at the Fernald Site (User's Manual, Revision B) and Calibration of NaI *In Situ* Gamma Spectroscopy Systems (Revision 0).

Although the EMS is a new instrument on a new and unique platform of an excavator, it behaves in many ways like the other sodium iodide (NaI) instruments but with several advantages. The ultrasonic sensors and the laser range finder provide the necessary, real-time feedback to the cab operator to allow a steady and consistent sweep of excavator arm and hence radionuclide scan. Also, with the EMS the detector, whether it be the NaI or the high-purity germanium (HPGe), is suspended out away from the excavator and is therefore not constrained by any shielding effects from the platform itself (unlike the other NaI platforms which interfere with the gamma photons).

The PID action level is 10 parts per million (ppm). Letter DOE-0172-02, "Organically Contaminated Soil Excavation Control," dated December 10, 2001, details the use of the PID for excavation control and for the characterization process in the former incinerator pad and the area behind the maintenance building. When the excavation/characterization process occurs in other areas besides the former incinerator pad and the area behind the maintenance building, the PID will be used as detailed in Letter DOE-0172-02, that is, supplemental to the portable gas chromatograph.

The information regarding precision and accuracy of the field gas chromatograph is detailed in the attached validation report for the field portable gas chromatograph.

Action: The draft EMS Report, which discusses the EMS specification and calibration, is attached to these comment responses.

The PSP will be revised to reflect the use of the photoionization detector as described in Letter DOE-0172-02.

The validation report detailing the precision and accuracy of the gas chromatograph is attached to these comment responses. The Analytical Laboratory Services Project Method 6549 will be revised to include precision and accuracy information for the portable gas chromatograph. The text of the PSP will be updated so that Method 6549 is referenced for precision and accuracy information.

SPECIFIC COMMENTS

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 1.2 Page #: 1-4 Line #: 7
Original Specific Comment #: 1
Comment: The text states that the PSP is expected to be implemented in the fall of 2001. The draft PSP was received by the regulatory agencies for review in November 2001 and cannot be implemented until it is approved by the regulatory agencies.

Response: Agreed. The implementation of the PSP for the organic soils associated with the maintenance building and incinerator pad were approved by the U.S. EPA on December 11, 2001 and Ohio EPA on December 10, 2001 as requested in Letter DOE-0172-02 dated December 10, 2001.

Action: None.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 2.2 Page #: 2-2 Line #: 9 and 10
Original Specific Comment #: 2
Comment: The text states that an action level of 721 parts per million uranium will be used for the EMS, which is the same action level as is used for the Radiation Tracking System, GATOR, and Radiation Scanning System. However, even though the EMS will use the same sodium iodide detector as these other radiation measurement systems, the EMS is a modification of existing equipment. Experience has shown that modifications can lead to different operating characteristics (such as registering different readings for a given source). Currently, no documentation exists to demonstrate that the existing action level is appropriate for the EMS. Such documentation should be provided to the regulatory agencies for review. If it cannot be established that the existing action level is appropriate for the EMS, a new, system-specific action level should be established for the EMS and provided in the PSP.

Response: Included with these comment responses is the draft EMS Report. The draft EMS Report describes the types of measurements that can be made with this new, real-time instrument, its uses and applications, and its strengths and limitations. Included also in the report is the calibration information and data for the EMS. Also included with these responses is the completed Acceptance Testing Plan on the EMS. The acceptance testing on the EMS was completed the week of December 4, 2001. The acceptance testing conducted on the EMS examined a number issues ranging from the reach capabilities of the excavator to the hydraulic drift (sag) experienced with the excavator arm supporting the EMS and its effect on real-time measurements.

Although the EMS is a new instrument on a new and unique platform of an excavator, it behaves in many ways like the other NaI instruments but with several advantages. The ultrasonic sensors and the laser range finder provide the necessary, real-time feedback to the cab operator to allow a steady and consistent sweep of excavator arm and hence radionuclide scan. Also, with the EMS the detector, whether it be the NaI or the HPGe, is suspended out away from the excavator and is therefore not constrained by any shielding effects from the platform itself (unlike the other NaI platforms which interfere with the gamma photons).

In terms of trigger levels and action levels, the User's Manual defines the application of trigger levels and action levels during characterization to meet waste acceptance criteria (WAC) attainment, hotspot delineation and final remediation level (FRL) attainment. Section 2.2 will be revised to reference the User's Manual in discussions pertaining to trigger levels and action levels.

Action: The draft EMS Report, which discusses the EMS specification and calibration, and the Acceptance Testing Plan for the EMS are attached to these comment responses.

Section 2.2 of the PSP will be revised to reference User's Manual application of trigger levels and action levels.

Commenting Organization: U.S. EPA — Commentor: Saric
Section #: 2.3.2 — Page #: 2-5 — Line #: NA
Original Specific Comment #: 3

Comment: The text states that the sideslopes of each excavation lift, the excavation bottom, and the sideslopes corresponding to the final lift elevation in above-waste acceptance criteria (WAC) organic areas will be screened using a PID and that if an action level for the PID is exceeded, physical samples will be collected or additional excavation will be performed. However, no action levels are provided for the PID. The action levels for PID screening and a justification for their selection should be provided in the PSP.

Response: Agreed. The action level for the PID is 10 ppm above background. This action level was selected because the level is a distinguishable concentration above background. This action level indicates elevated organic material, yet is near the detection limit of the instrument.

The original intent of the PSP was to utilize the PID as a screening device to determine where physical samples for GC analysis should be obtained. Since the submittal of the draft PSP, Letter DOE-0172-02 was approved by the regulatory agencies. This letter establishes that the PID will be used supplemental to the field GC in the area behind the

Maintenance Building and in the area of the former Incinerator Pad. The use of the PID supplemental to the portable GC will be applied to Area 3A/4A. In the future, data from the portable GC and PID may be correlated so that a basis for using the PID as a sole screening device may be established.

Action: The text of the PSP will be updated to: 1) Reflect an action level of 10 ppm above background, 2) include a justification for the selection of this action level, and 3) specify that wherever a physical sample for GC analysis is collected, a PID reading will be obtained at that location for possible future correlation.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 2.3.2 through 2.3.4 Page #: 2-6 through 2-8 Line #: NA
Original Specific Comment #: 4

Comment: In several locations in Sections 2.3.2, 2.3.3, and 2.3.4, the text presents a method for evaluating whether soil contamination is below WAC, upon reaching the final design depth in the contamination zone. The text then states that if another method of documenting that the soil contamination is below WAC is developed and is acceptable to the Waste Acceptance Organization, this new method may be employed instead of the previously described method. Any changes to the methodology used for evaluating whether soil contamination is below WAC should be reviewed and approved by the regulatory agencies before the changes are implemented. The text should be revised to state that this review and approval process will take place.

Response: Agreed. Any changes to the methodology used for evaluating whether soil contamination is below WAC will be reviewed and approved by the regulatory agencies prior to implementation.

Action: The referenced paragraphs found in Sections 2.3.2, 2.3.3, and 2.3.4 will be deleted.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 2.6.5 Page #: 2-18 Line #: NA
Original Specific Comment #: 5

Comment: The text states that a field GC will be used in Area 3A/4A for analysis for VOCs of concern in the organic soil contamination areas as well as in excavation water. The text indicates that "Analytical Laboratory Services Method 6549, Analysis of VOCs in Field Samples by Manual Headspace Using a Field Portable GC" will be used for all VOC analyses. The text should be revised to discuss the levels of precision and accuracy, and provide the detection limits achieved by this method.

Response: The information regarding precision, accuracy, and the detection limits of the field gas chromatograph is detailed in the attached validation report for the field portable gas chromatograph.

Action: The validation report detailing the precision, accuracy, and the detection limits of the field gas chromatograph is attached to these comment responses. The Analytical Laboratory Services Method 6549 will be revised to include precision and accuracy information for the portable gas chromatograph. The text of the PSP will be updated so that Method 6549 is referenced for precision and accuracy information. The PSP will also be updated so that the validation report addressing the detection limits is referenced.

Commenting Organization: U.S. EPA | Commentor: Saric
Table #: 2-4 | Page #: 2-34 | Line #: NA
Original Specific Comment #: 6

Comment: The container type for water samples to be analyzed for VOCs is identified as two 40-milliliter (mL) vials, but the required sample mass is identified as 120 mL, which corresponds to three 40-mL vials. The table should be revised to resolve this discrepancy.

Response: Agreed.

Action: Table 2-4 will be revised from 120 mL to 80 mL.

RESPONSES TO OHIO ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON THE DRAFT PROJECT SPECIFIC PLAN FOR AREA 3A/4A EXCAVATION CHARACTERIZATION AND PRECERTIFICATION (20200-PSP-0009, REVISION A)

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

GENERAL COMMENTS

Commenting Organization: Ohio EPA Commentator: OFFO
Section #: General Pg. #: Line #: Code: C
Original Comment #: 1

Comment: All sections of this PSP which discusses excavation strategy for the organically contaminated soil should be revised to reflect the method approved in the document "Organically Contaminated Soil Excavation Control," approved by the OEPA on December 10, 2001, including Table 2-3.

Response: Agreed.

Action: Text throughout the Project Specific Plan (PSP) will be updated to agree with the Letter DOE-0172-02, "Organically Contaminated Soil Excavation Control".

Commenting Organization: Ohio EPA Commentator: OFFO
Section #: General Pg. #: Line #: Code: C
Original Comment #: 2

Comment: This will be the first time a PID has been used to assist in excavation monitoring on such a large scale. A record should be kept as to the PID readings at the exact locations physical samples are taken. This will allow a comparison to be made for future reference between PID readings and actual physical sample results.

Response: Agreed.

Action: Text will be updated so that wherever a physical sample for gas chromatograph (GC) analysis is collected, a photoionization detector (PID) reading will be recorded at that location.

Commenting Organization: Ohio EPA Commentator: OFFO
Section #: General Pg. #: Line #: Code: C
Original Comment #: 3

Comment: Action levels should be developed for the PID. COCs should be evaluated to determine if the action level should be temperature dependent depending on the volatility of the organic substance. Frozen soil would also cause the quantity of volatiles to be greatly underestimated.

Response: Agreed. The action level for the PID is 10 parts per million (ppm) above background. This action level was selected because the level is a distinguishable concentration above background. This action level indicates elevated organic material, yet is near the detection limit of the instrument.

The original intent of the PSP was to utilize the PID as a screening device to determine where physical samples for GC analysis should be obtained. Since the submittal of the draft PSP, Letter DOE-0172-02 was approved by the regulatory agencies. This letter establishes that the PID will be used supplemental to the field GC in the area behind the Maintenance Building and in the area of the former Incinerator Pad. The use of the PID supplemental to the portable GC will be applied to Area 3A/4A. In the future, data from the portable GC and PID may be correlated so that a basis for using the PID as a sole screening device may be established. Therefore, the need to establish a temperature-dependent PID action level is not required at this time. Evaluation of the PID and portable GC data in the future will determine if a temperature-dependent PID action level is necessary.

Action: The text of the PSP will be updated to reflect an action level of 10 ppm above background and to specify that wherever a physical sample for GC analysis is collected, a PID reading will be obtained at that location for possible future correlation.

Commenting Organization: Ohio EPA Commentator: OFFO
Section #: General Pg. #: Line #: Code: C
Original Comment #: 4

Comment: The HPGe detectors used at the FEMP have been supported by a tripod. With the EMS, the detector is mounted on an excavator arm. Our concern is that motion of the detector caused by swaying of the excavator arm or relaxing of the excavator hydraulics may be large enough to skew the results. An analysis should be performed to establish that the detector can be held motionless enough to give valid results. Standards should be established that enable the Characterization project staff to determine if the amount of unintentional sway in the excavator arm during the course of the measurement is small enough to yield reliable data.

Response: Analyses and evaluations were performed during the acceptance testing of the Excavation Monitoring System (EMS) and the calibration of the sodium iodide (NaI) detector on the EMS looking at the excavator arm swing and its effect on measurements. The acceptance testing and calibration were completed in two testing events which occurred in June and December 2001. An Acceptance Test Report was produced to document the results of the acceptance testing. The EMS Report, "Development and Deployment of the Excavation Monitoring System (EMS, Revision 1, PCN 1)," was developed to describe the EMS and the types of measurements that can be made with it, its uses and applications, and its strengths and limitations. Both of these reports are included with these comment responses.

In terms of excavator arm sway, no measured sway of the boom and stick position was observed during the static condition or scanning mode at the nominal 1 mile per hour speed (the hydraulic sway stabilizers effectively eliminate any sway). Figure 2-1 of the EMS Report identify the two swing dampers. The stability of the excavator system hydraulics were also evaluated and is discussed in the acceptance plan. Essentially, the system hydraulics maintain a fixed detector height if the excavator engine RPM was raised slightly above idle providing a positive hydraulic pump output. Increasing the RPM of the engine, the operator was able to compensate for the slight downward drift due to hydraulic pressure leak-off at idle. The hydraulic drift was measured at ½ inch in a five-minute period. Since the NaI detectors are more efficient (able to collect more counts in a given period of time) than the high-purity germanium (HPGe) detectors, the two conditions (manual downward drift compensation and positive pump output using increased engine RPM) were statistically compared using NaI detector data acquired at the Real-Time Instrumentation Measurement Program (RTIMP) calibration pad. Counting statistics were comparable for both conditions of hydraulic system operation (manual downward drift compensation and positive pump output). Standard practice has been established to operate using positive hydraulic system pressure to maintain a fixed detector geometry.

Additionally, although the EMS is a new instrument on a new and unique platform of an excavator, it behaves in many ways like the other NaI instruments but with several advantages. The ultrasonic sensors and the laser range finder provide the necessary, real-time feedback to the cab operator to allow a steady and consistent sweep of excavator arm and hence radionuclide scan. Also, with the EMS the detector, whether it be the NaI or the HPGe, is suspended out away from the excavator and is therefore not constrained by any shielding effects from the platform itself (unlike the other NaI platforms which interfere with the gamma photons).

Action: The EMS Report, "Development and Deployment of the Excavation Monitoring System (EMS)" and the Acceptance Test Report are attached to these comment responses.

Commenting Organization: Ohio EPA — Commentator: ODH
Section #: General — Pg. #: — Line #: — Code: C
Original Comment #: 5

Comment: Corrections for topographic effects in general are largely addressed in the "Users Manual." Specifications for how measurements on steep slopes, pits, and well-like geometry may impact MDC's, trigger levels, system uncertainties, and angular response bias needs to be documented for these systems in order to serve as a template for the remainder of the production area.

Response: As noted in the comment, the general affects on the *in-situ* counting statistics due to a deviation from the 2 pi geometry are addressed in the User Guidelines, Measurement Strategies, and Operational Factors for Deployment of *In Situ* Gamma Spectrometry at the Fernald Site (User's Manual, Revision B). The User's Manual describes the deviation caused by measuring other than flat ground would in all cases be an overestimation up to a factor of two at maximum. The technical basis for the User's Manual has since its development been documented by the Department of Energy, Environmental Measurements Laboratory (DOE-EML) in EML-603, "Fluence Evaluations For Applications of *In Situ* Gamma Spectroscopy in Non-Flat Terrain". EML-603 provides mathematical corrections for deviations from the half-space geometry. The equations in EML-603 have been used to provide geometry corrections in the EMS Report. To perform these corrections the solid angle subtended by the soil will be determined and documented for these types of measurements. This correction will be implemented only in the case if waste acceptance criteria (WAC), hotspot criteria, and or final remediation levels (FRLs) are exceeded in the uncorrected results based on the application of the trigger levels. Section 5.3.3 of the EMS Report discusses the geometric corrections.

Action: The EMS Report is attached to these comment responses.

Commenting Organization: Ohio EPA Commentator: ODH
Section #: General Pg. #: Line #: Code: C
Original Comment #: 6

Comment: Have all potentially contributors to gamma shine been identified in the area proximal to 3A/4A?

Response: The User's Manual documents all potential sources of shine at the FEMP. Table 4.12-1 identifies the large sources of shine in proximity to Areas 3A and 4A. This table, even though dated in 1998, is still accurate. Lesser sources of shine may exist in local areas near specific excavation locations to be characterized due to changes in the terrain and relocation operations involving potential sources caused by remedial activities. Each *in situ* measurement location is evaluated for radiological interference during the performance of the acquisition in accordance with the RTIMP Quality Assurance Plan. Field measurement procedures require micro-r-meter surveys to be taken to discover sources of interference prior to *in situ* measurement.

Action: None.

SPECIFIC COMMENTS

Commenting Organization: Ohio EPA Commentator: OFFO
Section #: 1.1 Pg. #: 1-2 Line #: 28 Code: C
Original Comment #: 7

Comment:

a) The excavator mounted, EMS is referenced throughout the document. This scanning equipment has not been approved for use by the Agencies yet. It should be clearly stated that the EMS will not be used prior to Agency approval.

b) A section should be added to the User's Guide covering the EMS. The range of discussion and the depth of detail should be similar to that of topics that are currently covered. The section should be written to assist the Characterization staff in utilizing the technology to give reliable and valid data. Topics to be addressed should include: detector field of view, influence of standing water, detector height, etc. The discussion should also reference Section 4.9 of the User's Guide, "Topographic Effects".

Response: Included with these comment responses is an update to the User's Manual for the application of the EMS. A separate report on the EMS including its operational capabilities and limitations is also included with these responses. The report will include calibration information as was done for the other RMS systems.

Action: The update to the User's Manual for the application of the EMS and the separate report on the EMS including its operational capabilities and limitations are attached to these comment responses.

Commenting Organization: Ohio EPA Commentator: OFFO
Section #: 1.2 Pg. #: 1-4 Line #: 15-17 Code: C
Original Comment #: 8

Comment: Please rephrase this sentence so it reflects the same meaning as described on Page 3-2, Section 3.4.

Response: Agreed.

Action: The PSP text will be updated so that Section 3.4 is referenced.

Commenting Organization: Ohio EPA Commentator: OFFO
Section #: 2.3.3 Pg. #: 2-6 Line #: 28-29 Code: C
Original Comment #: 9

Comment: No plan for the physical sampling of Tc-99 is discussed. What will be the sampling intervals along the side slopes and the bottom?

Response: The structure of the PSP regarding the physical sampling of Tc-99 may have caused confusion. The Tc-99 sampling intervals are discussed in Section 2.6.8.3. Due to the approval of Letter DOE-0172-02, the PSP text regarding Tc-99 sampling requirements will be revised to comply with this letter.

Action: The text of the PSP regarding Tc-99 sampling requirements will be updated to comply with Letter DOE-0172-02.

Commenting Organization: Ohio EPA Commentator: OFFO
Section #: 2.3.3 Pg. #: 2-7 Line #: 12 Code: C
Original Comment #: 10

Comment: If the NaI scanning data is not downloaded to the SED, upon reaching the final design depth in the contamination zone…*in situ* gamma equipment will be used to obtain a measurement…" Why would the NaI scanning data not be downloaded? All characterization data should be documented and recorded. It is unacceptable to not save information on characterization, and then redo the characterization with another method. This could be seen as biasing results.

Response: Agreed.

Action: All characterization data will be downloaded to the Sitewide Environmental Database (SED). The paragraph noted above will be deleted, as well as similar paragraphs found in Sections 2.3.2 and 2.3.4.

Commenting Organization: Ohio EPA Commentator: OFFO
Section #: 2.3.4 Pg. #: 2-7 Line #: 16-17 Code: C
Original Comment #: 11

Comment: "If another method of documentation that the soil is below-WAC is developed that is acceptable to WAO, this method may be employed instead of the previously described method." This sentence is found throughout the document, and is unacceptable. Only methods approved by the Agencies (i.e., approved in a document) are acceptable. No changes in method are to be made without prior approval.

Response: Agreed.

Action: This paragraph, as well as similar paragraphs found in Sections 2.3.2 and 2.3.3, will be deleted.

Commenting Organization: Ohio EPA Commentator: OFFO
Section #: 2.3.4 Pg. #: 2-8 Line #: 20-21 Code: C
Original Comment #: 12

Comment: "*In situ* gamma results will not override any data obtained from redesign." This sentence is confusing. It is assumed that the intention of this sentence is to state the protocol that an area of excavation may be expanded with *in situ* scanning, but never reduced in size. Scanning may never override the results of physical sampling. Please clarify this paragraph.

Response: Agreed. The intent of this paragraph was not to expand an area of excavation, the intent was to reduce the size of the excavated area surrounding an above-WAC uranium point. In order to delineate the areas of excavation, during predesign, if data indicated that an above-WAC location existed then data from other physical samples surrounding this point was evaluated. The sample location closest to the above-WAC location, which was found to be below-WAC, was used to bound this above-WAC point as the area requiring excavation. To reduce the amount of soil requiring excavation, this PSP proposes to use gamma *in situ* equipment to delineate a smaller excavation area around this above-WAC location. This would reduce the amount of excavation of soil required surrounding this above-WAC uranium point. It was never the intent that *in situ* scanning would override the result of physical sampling. If a location was found to be above-WAC during predesign, the area requires excavation. *In situ* scanning, though, could be used to reduce the excavation area since it is characterizing the area around a specific above-WAC point, it is not relying on results from the nearest physical sample.

Action: The paragraph in Section 2.3.4 will be revised.

Commenting Organization: Ohio EPA Commentator: OFFO
Section #: 2.3.5 Pg. #: 2-8 Line #: 29-32 Code: C
Original Comment #: 13

Comment: These sentences reference finding above-FRL levels at the bottom and sides of the excavation before design depth and delineating these levels. Since interim scanning in above-FRL areas is for WAC determination between lifts, it is assumed these sentences should be referencing WAC, not FRL.

Response: Agreed.

Action: "Above-FRL" will be changed to "above-WAC" in these sentences.

Commenting Organization: Ohio EPA Commentator: OFFO
Section #: 2.3.6 Pg. #: 2-9 Line #: 23 Code: E
Original Comment #: 14

Comment: Change the words "may be collected" in this sentence to "will be collected."

Response: Agreed.

Action: This section will be re-worded to agree with Letter DOE-0172-02, "Organically Contaminated Soil Excavation Control" dated December 10, 2001. Wording will clarify that a field GC sample will be collected if an action level of 10 ppm is exceeded.

Commenting Organization: Ohio EPA Commentator: ODH
Section #: 2.4.2 Pg. #: 2-12 Line #: Code: C
Original Comment #: 15

Comment: Page 2-12 mentions a 50-foot interval for sampling bedding and soil from trench excavations. How was this value arrived at? Was three-dimensional mapping or other characterization data used to determine if impacted perched water has contacted utility trenches and been transported along the various lines? In addition, gamma scans are to be made on a pad of minimum 6-inch thickness of trench floor soil and bedding materials. Shouldn't this be a maximum 6-inch thickness? It also seems risky to backfill trenches before physical samples indicate FRLs have been met.

Response: The 50-foot interval suggested for scanning the trench soil and bedding material with HPGe was arbitrarily chosen. With the completion of the EMS development, the plan will be to use the EMS where real-time scanning is required. When real-time scanning is required, the EMS will be used to first scan the surface soils overlying the trench. In 3-foot (+/- 1 foot) increments the soils overlying the utility will be removed with an EMS (NaI-based) scan conducted between lifts as required. The resulting soil and material collected from the trench in the immediate vicinity of the pipe (including bedding material) will be placed along side the trench, spread out and arranged in circular patterns so that it is 6 inches or less in thickness and 3 feet or less in diameter. In this configuration, HPGe (either via tripod mounted or EMS) measurements will be performed.

In terms of back-filling the trench will be left open until the certification results are available as long as the trench is stable and the bottom of the trench is not within the limits of the aquifer specified for back-filling or clay plugging.

Action: Section 2.4.2 of the PSP will be clarified so that the trench will be back filled following evaluation of results from the following: 1) HPGe measurement, 2) any physical samples obtained and analyzed for Tc-99 or organic WAC, and 3) any physical samples obtained for certification purposes. Section 2.4.2 will also be revised to state that the resulting soil and material collected from the trench in the immediate vicinity of the pipe will be arranged so that it is 6 inches or less in thickness and 3 feet or less in diameter.

Commenting Organization: Ohio EPA Commentator: OFFO
Section #: 2.4.2 Pg. #: 2-12 Line #: 18-19 Code: C
Original Comment #: 16

Comment: In the interest of more complete coverage of the trenches, the following sampling is proposed: If HPGe tripod measurements are to be taken, the bucket-loads of sample material from the pipe bedding and native underlying soil should be taken at opposite 25-foot intervals. In this manner both the pipe bedding and underlying soils will be sampled at 50-foot intervals, but the pipe bedding interval will be located 25 feet from the underlying soils interval.

Response: It is envisioned that the underlying soil and bedding material are sufficiently intermixed, or will certainly be so after removal, that to separate the two during excavation would be difficult. Ultimately, as Ohio EPA points out in the comment above, the integrity of the HPGe measurements is determined by the care taken with properly spreading (both in thickness and diameter) the soil and bedding material to be scanned.

Action: None.

Commenting Organization: Ohio EPA Commentator: OFFO
Section #: 2.4.3 Pg. #: 2-12 Line #: 26-27 Code: C
Original Comment #: 17

Comment: A physical sample **will** be collected from bedding material for WAC attainment purposes. Please correct the language in this sentence.

Response: Agreed, for organic or Tc-99 areas of concern.

Action: This sentence will be revised to read "will be required" and will specify applicability for organic or Tc-99 areas of concern.

Commenting Organization: Ohio EPA Commentator: OFFO
Section #: Table 2-1 Pg. #: 2-31 Line #: Code: C
Original Comment #: 18

Comment: On Table 2-1, the list of COCs for Area 3A/4A is incomplete. Additional COCs including metals, SVOCs and pesticides/PCBs are appropriate considering the numerous processes and waste handling operations that occurred within 3A/4A. The COC list must be expanded to appropriately address all contaminants for 3A/4A.

Response: The title for this table is misleading, as is the inclusion beryllium. The intent of this table is to only address the constituents of concern (COCs) driving excavation for precertification purposes. The expectation of precertification is that by excavating the COCs addressed in Table 2-1 (disregarding beryllium), the other COCs will be excavated. Once precertification is completed, the certification of Area 3A/4A will occur. The entire list of COCs will be addressed in the certification phase, which will be covered by a separate Certification PSP. In the event that all COCs found in Area 3A/4A were not removed during precertification, additional excavation of these COCs will be addressed in the Certification PSP.

Action: The title of Table 2-1 will be changed to "Limits for Area 3A/4A Excavation Controlling COCs". Additionally, the information addressing beryllium will be deleted, as this COC does not drive excavation. A section will be added to the PSP to address physical sampling for aroclor-1254.

Commenting Organization: Ohio EPA Commentator: OFFO
Section #: Table 2-3/*** Pg. #: 2-33 Line #: 12-13 Code: C
Original Comment #: 19

Comment: The last bullet below the tables should be rephrased. If the action level for the PID is exceeded, shouldn't the language read "further excavation may occur and GC analysis **will** be collected" at that location?

Response: Agreed.

Action: The footnote will be rephrased. Due to the issuance of Letter DOE-0172-02, "Organically Contaminated Soil Excavation Control" dated December 10, 2001, the second footnote will be deleted, so that the third footnote will become the second footnote in the revised document.

Commenting Organization: Ohio EPA Commentator: OFFO
Section #: Table 2-4 Pg. #: 2-34 Line #: Code: C
Original Comment #: 20

Comment: Several parameters appear to be missing from the Analytical Summary, Table 2-4. Please include all COCs from 3A/4A in the summary table?

Response: The title of this table is misleading. The intent of this table is to address the COCs driving excavation during precertification that are physical samples. Once precertification is completed, the certification of Area 3A/4A will occur. The entire list of COCs will be addressed in the certification phase, which will be covered by a separate Certification PSP. In the event that all COCs found in Area 3A/4A were not removed during precertification, additional excavation of these COCs will be addressed in the Certification PSP.

Action: The title of Table 2-4 will be changed to "Analytical Requirements for Physical Samples Summary Table". Aroclor-1254 will be added to this table.

Commenting Organization: Ohio EPA Commentator: OFFO
Section #: 3.0 Pg. #: 3-1 Line #: 13-15 Code: C
Original Comment #: 21

Comment: This sentence mentions that the sampling equipment will be "decontaminated by Level II methods as outlined in the applicable sampling procedure." Please include the sampling procedure number in the text.

Response: Agreed.

Action: Sampling procedures SMPL-01 and SMPL-02 will be referenced in this sentence.

2.6 EMS MEASUREMENTS

Background

The Excavation Monitoring System (EMS) is a self-contained gamma detection system. It is capable of deploying the NaI and HPGe gamma spectrometry systems that have been in routine use at the FEMP. It is attached to a standard excavator and includes a self-righting vertical arm, which attaches to a detector mount and detector. The vertical arm is suspended from a horizontal platform that is coupled to the arm of the excavator and holds an on-board computer, global positioning system (GPS) and laser-based location measurement systems, and data transmission equipment. The GPS and laser-based position measurement systems provide redundant means of measuring the location at which each gamma spectral measurement is performed. Other major components of the system include excavator cab and support van computers, data processing software, and display screen. If needed, a 2-foot or 4-foot extension can be added to the vertical arm of the unit to extend the reach of the system into deeper excavations.

The EMS is intended to be applied to non-standard survey situations that cannot be handled by the other platforms, for example, surveys of pits, trenches, mounds, vertical surfaces, soft or wet ground, or locations where access is difficult or unsafe. In the latter situations, the EMS protects workers and reduces their potential exposure, and therefore, advances the objectives of ALARA and worker health and safety. The EMS provides a substantial improvement in meeting ALARA objectives compared to what could be accomplished with other available methods.

Real-time gamma measurements can be made in several modes, including stationary measurements at a prescribed detector height or offset and mobile scanning measurements with either detector at a prescribed detector height and scanning speed. Either gross activity or spectrometric measurements can be collected in any of these modes. All stationary or mobile measurements are tagged with detector location as determined by the on-board GPS or laser-based systems. The movement of the EMS-mounted detector over the survey area is tracked using either the GPS or a laser-based tracking system that traces detector location on display screens in the excavator cab and in the support van.

The EMS is intended for use in same phases of the FEMP soil remediation program as the other real-time platforms, namely in excavation predesign, excavation support, and precertification. The main survey activities associated with these program phases are delineation of excavation boundaries, identification of soil with concentrations of uranium above the waste acceptance criteria (WAC) for the On-Site Disposal Facility (OSDF), identification of hotspots, and checking residual contaminant levels to confirm the effectiveness of cleanup actions. The use of the EMS is discussed in a report entitled "Development and Deployment of the Excavation Monitoring System," (DOE 2002a), hereafter called the "EMS Manual."

EMS Description and Operation

The main component of the EMS, which is mounted on the arm of a standard excavator, is called the excavator tool (ET). A drawing of the ET is shown in Figure 2.6-1, which identifies the major components of the device. The ET stands approximately 72 inches tall, by 32 inches wide, by 50 inches deep, with HPGe detector mounted, but excluding the available 2-foot or 4-foot detector mount extensions. The entire unit weighs roughly 200 pounds, while the removable detector assembly weighs roughly 46 pounds. Other major components of the EMS include computers and displays located in the excavator cab and in the support van.

The mechanical components of the ET include an excavator adapter, which allows fast and simple attachment to a hydraulic coupler mounted on the arm of an excavator. The excavator adapter is attached to the main platform of the unit on which are mounted the system computer and other system communications and GPS components. The horizontal unit is articulated and can pivot about a swing damper that provides half of the freedom of movement that allows the mast assembly to maintain a vertical orientation. A similar damper, mounted at right angles to the first affords the other half of the freedom of movement, and connects the mast assembly to the horizontal platform.

A gamma-sensitive detector is suspended from the excavator arm at the end of the mast assembly. The signal processing modules, antennae and other electronic equipment are housed on the horizontal platform, referred to as the boom assembly, located at the top of the mast assembly. A 2-foot or 4-foot extension rod may be attached between the lower end of the mast assembly and the detector to enable the detector to reach the bottom of deeper excavations. Each detector assembly is equipped with four ultrasonic proximity sensors, which provide collision warning signals when the detector approaches an excavation wall or other nearby object. Each detector assembly is also equipped with a look-down laser range finder capable of measuring the distance to the surface being surveyed. The laser range finder functions as a collision warning system, but more importantly, it allows positioning of the detector at the appropriate height above the surface being surveyed in accordance with standard procedures.

Three computers are used in the EMS, one mounted on the ET, one in the excavator cab, and one in the support van situated near the excavator. The ET-mounted computer performs important signal processing and data transmission functions associated with the collection of measurement and position data from sensors and detectors on the ET. The integrated data are transmitted via a wireless Ethernet connection to the other two computers, which display and record the data as needed. Display panels on the excavator cab and support van computers provide the information to the excavator operator and EMS operators needed to position the device and interpret gamma readings as they are made.

Two main types of data result from EMS operations, namely measurement location data and gamma spectral data. A number of sensors, receivers, and detectors generate the data. The EMS uses the three mentioned computers for data collection, processing, and display. These inputs are routed through a peripheral component interconnect (PCI) bus to a Cisco Wireless Ethernet Adaptor, which transmits the data to the excavator- and van-mounted computers, which have corresponding wireless Ethernet receivers. Data are ultimately transferred to the Sitewide Environmental Database (SED) for further use and archiving.

The excavator cab computer and display serve as the excavator operator's main interface with the system, in addition to his visual view of the ET or of someone who is spotting for him. The display screen is mounted in a convenient location in the excavator cab, and features a touch screen display. Touching the "Draw Scaled Coverage" button on the screen will pull up a scaled coverage plot similar to that available on other RMS systems.

Other information on the excavator cab display includes a numerical reading of latitude and longitude readings from the GPS or ArcSecond laser-based positioning systems, and of detector-to-ground offset as determined by the detector-mounted laser range finder. Also displayed are four lateral hazard warning lights activated when the ET approaches a lateral object within a preset limit as determined from readings from the four laterally mounted ultrasonic sensors on the ET. This information is used primarily to protect the detectors from collisions during scanning.

The support van computer is used to control data acquisition functions of the devices mounted on the excavator tool, mainly the gamma detectors and positioning systems. System software is capable of controlling and acquiring data from both NaI and HPGe detectors. The system can be operated in either static or mobile scanning modes. Setup and control functions in the van can select between static and repeated scanning measurements and allow setting measurement duration in either live time or real (actual) time. The menu-driven system also allows recording the physical tool configuration and orientation with respect to the excavator.

The van display can be toggled between plan view and spectrum view. Gamma spectra are displayed as they accumulate over time in terms of counts recorded per MCA channel. The Environmental Gamma Analysis Software (EGAS), when loaded can analyze spectral data from either NaI or HPGe detectors to produce a calibrated energy spectrum. The software can further analyze such spectra to determine the identities and activities of the radionuclides corresponding to the recorded spectral peaks. Worksheet and log-file functions can also be loaded into the system.

Quality control (QC) checks are performed on the data using validation checklists in the mapping van immediately after collection in accordance with the *In Situ* Gamma Spectrometry Addendum to the Sitewide CERCLA Quality Assurance Project Plan (DOE 1998a). Fully processed and reviewed measurements collected on a given day, or portion of a day, are transferred to the Real-Time Directory of the FEMP Local Area Network (LAN) via a Wireless Ethernet connection, or computer diskettes on a daily basis. After QC checks are performed on the data on the LAN, approved data are sent to the SED for storage and archiving.

EMS Calibration

The NaI detector used in the EMS is calibrated on the FEMP calibration pad following the approach used for the other platforms, as discussed in the Area 3A/4A Implementation Plan (DOE 2001a). The efficiencies determined for the detector in December 2001 are presented in the EMS Report.

EMS Applications

Expected applications of the EMS in the Former Production Area include use in elevated contamination areas and in difficult-to-access areas where use of other available platforms would pose a physical and/or contamination hazard to workers. A broad class of such situations is use in deep excavations, particularly those with steep walls such as utility trenches. The use of the EMS would always be preferred in these areas. However, its use is limited to areas that are accessible to the large excavator on which the system is mounted.

The use of *in situ* measurements in support of excavation activities is described in the Sitewide Excavation Plan (DOE 1998b), and the methods for performing these measurements using the available *in situ* gamma detector platforms is detailed in this manual. The principles and procedures given in this manual for performing these functions will be followed for all EMS measurements.

Because of the ability of the EMS to deploy both NaI and HPGe detectors for either fixed position or mobile measurements, it can be used to make all the measurements made by the currently used platforms. In situations where either the EMS or current systems could be used, the choice will depend on the suitability of the platform to the area, including the size of the area and the time required for performing surveys.

Geometry Corrections

In situ gamma measurements are influenced by measurement geometry. Detectors calibrated to measure radionuclide concentrations in surface soils on flat ground will give a higher or lower result for the same soil concentration when the measurement geometry (i.e., the soil surface contributing to the reading) is not flat. Such changes in the results are completely predictable from geometric considerations and correction factors for various non-flat geometries have been computed and are presented in EML-603, "Fluence Evaluations For Applications of *In Situ* Gamma Spectroscopy in Non-Flat Terrain" (Miller 1999). The application of these correction factors to EMS detector readings is discussed further in the EMS Manual.

For nearly all cases that will be encountered in FEMP excavations, the effects due to non-flat terrain are such that results will be biased high. That is, measurements are conservative. In cases where such a conservative bias leads to unnecessary excavation, corrections for non-flat geometry may be applied to obtain more accurate measurements. Figure 2.6-2 shows the procedure for making geometric corrections.

As shown in the figure, readings below the action levels will not require correction because any such correction would only reduce the reading further, assuming a positive bias for all below-grade readings. Conversely, all readings in excess of twice action levels would indicate an above-action level condition, because the maximum correction for geometry is a factor of two. Readings between the action level and twice the action level are thus inconclusive and warrant correction for geometry.

A detailed study of the effects of non-flat terrain on *in situ* gamma measurements was conducted by EML and is detailed in EML-603 (Miller 1999). This report serves as the basis of geometry corrections that will be applied to *in situ* gamma measurements made at the FEMP, including those made with the EMS.

Under EML-603, corrections for non-flat terrain require the determination of the total solid angle subtended by the surface contributing to the reading. For flat geometry, the solid angle is 2π. To correct readings calibrated to 2π geometry, the solid angle subtended by the non-flat reading, Ω, is divided by

2 π to yield a correction factor, generally between 1 and 2. Non-flat readings are then corrected by dividing by this factor.

To determine the solid angle subtended by the non-flat measurement, some simple information on the geometry is needed, as described in EML-603. The information includes H, the depth of the excavation; h, the height of the detector from the floor of the excavation; and X, the horizontal distance from detector to the wall of the excavation. The values of H, h, and X are used to determine the angle from the detector to the excavation top edge, known as the horizon angle, θ. The solid angle, Ω, can then be determined using equations in EML-603 for various pit shapes. Refer to the EMS Manual and EML-603 for instructions on making corrections for geometry.

Operational Considerations

Excavation characterization support with the EMS will be carried out in a rapid turnaround fashion as is currently done with the other *in situ* gamma spectrometry systems. The EMS support van will also serve as the mapping van for data reduction, review, and mapping. Every effort will be made to produce excavation maps based on EMS data within 24 hours of data collection. In this way, excavation activities can proceed with minimal interruption. It may be possible for characterization and excavation activities to be conducted at the same time in different parts of an excavation area.

Interpretation of data with respect to WAC, hotspot, or FRL criteria will be based on data uncorrected for geometry to a large extent. When readings are near the respective criteria, the affected area will be flagged for further analysis involving corrections for geometry. No excavation would take place in the flagged area until the corrected results were available. It is expected that the necessary geometric measurements needed to perform the corrections could be performed shortly after the generation of measurements that are in the inconclusive range.

In time sequence, real-time EMS data will be processed in the mapping van to generate uncorrected measurements within an hour or two of data collection. In many cases it will be possible to collect the required pit dimensions for corrections on the same day. Corrections will be computed in short order using simple calculations. Corrected data and excavation maps generated from the data are expected to be available by the end of the following workday in most cases.

2.6.1 EMS Strengths and Limitations

2.6.1.1 EMS Strengths

- Use of the EMS can greatly reduce hazards to worker and worker exposure when working in inaccessible areas or in contamination areas
- EMS can be used in areas that cannot be surveyed by any other platform
- EMS can deploy both NaI and HPGe detectors
- EMS can perform all of the measurement functions of the other real-time platforms
- The EMS excavator can operate in soft soils
- EMS facilitates a continuous excavation process.

2.6.1.2 EMS Limitations

- The large excavator that supports the EMS requires wide and high access to survey areas
- The HPGe detector is not provided with physical protection to limit damage to the detector from collisions
- Geometric corrections for measurements in non-flat terrain may be required (as for any real-time platform).

2.6.2 Guidance

- Refer to all appropriate reference manuals when deploying the EMS which include this manual and the following:
  - Development and Deployment of the EMS (EMS Manual, DOE 2002a)
  - Sitewide Excavation Plan (DOE 1998b)
  - Implementation Plan for Area 3A/4A IRDP (DOE 2001a)
  - Project Specific Plan for Area 3A/4A Excavation Characterization and Precertification (DOE 2001b)
  - Calibration of NaI *In Situ* Gamma Spectrometry Systems (DOE 2001c)
  - *In Situ* Gamma Spectrometry Addendum to the Sitewide CERCLA Quality Assurance Project Plan (DOE 1998a)

- EML-603, Fluence Evaluations For Applications of *In Situ* Gamma Spectroscopy in Non-Flat Terrain (Miller 1999)

- EMS II Acceptance Testing Plan (DOE 2002b).

- Plan the coordination of excavation and characterization activities. Consider the need to use the EMS inside the excavation footprint.

- Determine which detector (NaI or HPGe) will be required for various purposes. See the reference documents mentioned.

- Follow the procedures in this manual for performing various measurement functions, consistent with the other real-time platforms.

- Determine the need and the procedure for making geometry corrections in non-flat terrain. Follow the EMS manual. In cases where the uncorrected concentration is above a trigger level and the corrected concentration is below the trigger level, the affected area must be investigated further to ensure that the contamination is uniformly distributed. If contamination is not uniformly distributed, the geometry correction shall not be applied.

2.6.3 See Also

2.1 Overview of Uses of *In Situ* Gamma Systems in FEMP Soil Remediation
4.2 RTRAK Single Measurement Fiedl of View
4.5 Trigger Levels
4.8 RTRAK Total Activity Data Interpretation
4.11 Environmental Influences on *In Situ* Gamma Spectrometry Data
4.12 Shine
4.14 Time Required for *In Situ* Gamma Spectrometry Measurements
4.15 Seasonal Precautions
4.16 Mapping Conventions
5.1 Minimum Detectable Concentrations
5.3 Radium-226 Corrections
5.4 Data Review and Validation
5.6 Field Quality Control Considerations
5.7 Positioning and Surveying

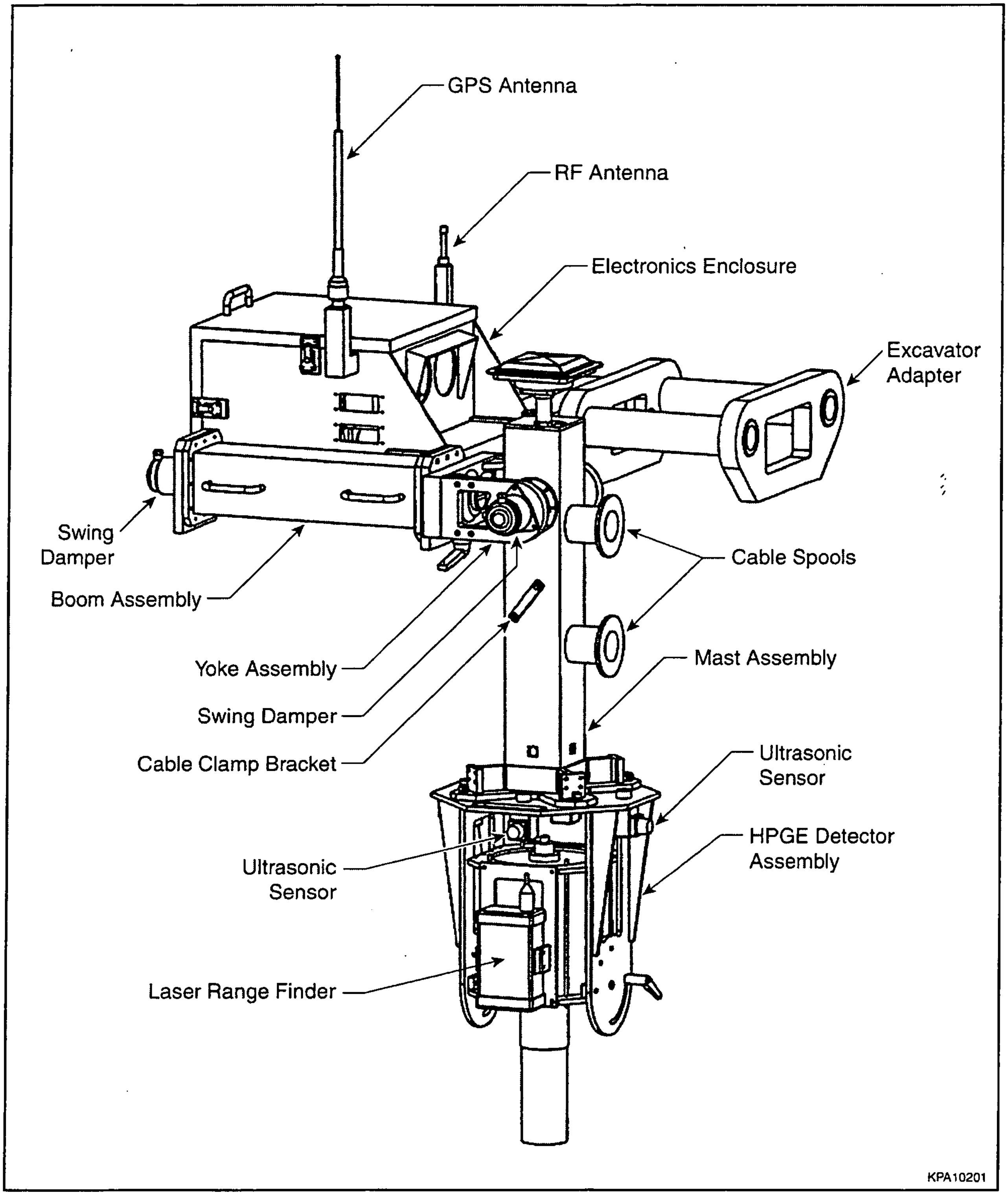

Figure 2.6-1 The Excavator Mounted Portion of the EMS with HPGe Detector Attachment

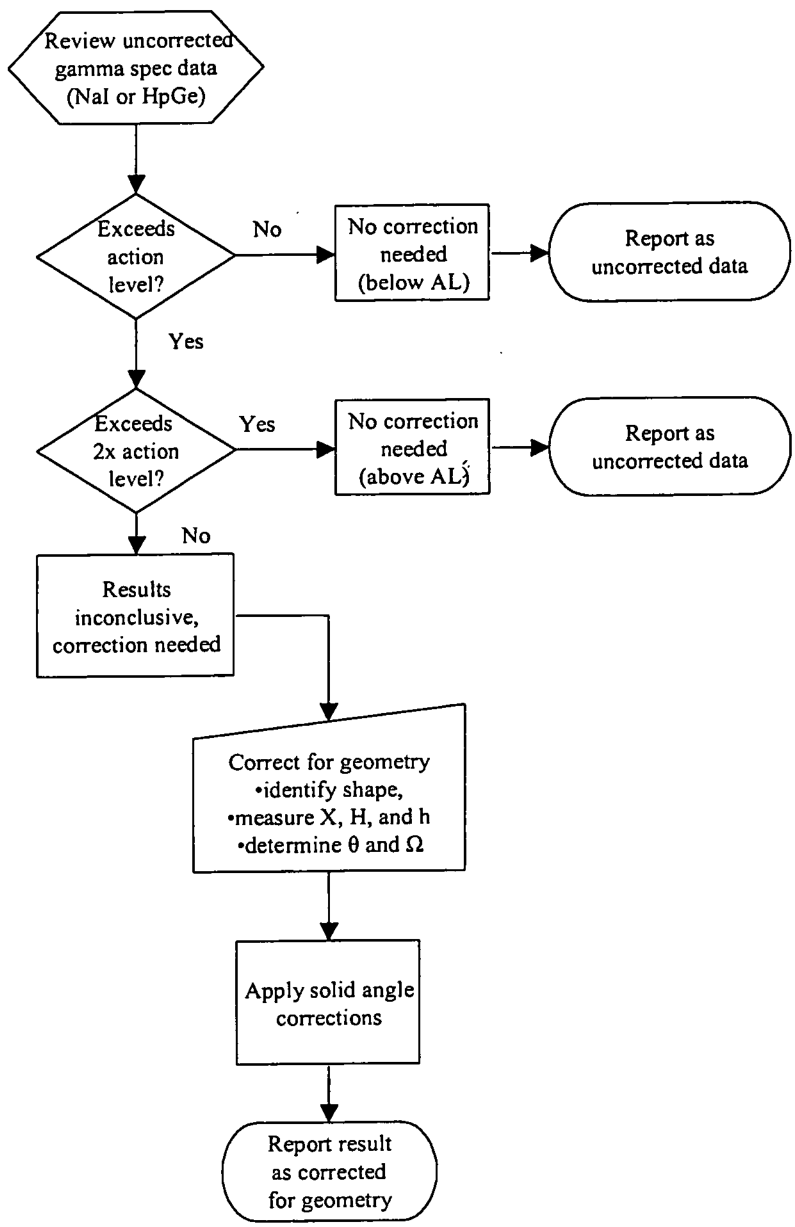

Figure 2.6-2 Procedure for Application of Geometric Corrections for Non-Flat Terrain