DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND
2405 GUN SHED ROAD
FORT SAM HOUSTON, TEXAS 78234-1223

REPLY TO
ATTENTION OF

August 5, 2011

Safety Office

Mr. Dominick Orlando
Division of Waste Management and Environmental Protection
US Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, Maryland 20852-2738

Dear Mr. Orlando:

As Radiation Safety Officer on source material license SUB-1435 (Docket NO. 040-08838), I am enclosing our responses to the comments in your March 10, 2011 letter about our partition coefficient (K_d) testing needed for the decommissioning plan for the Jefferson Proving Ground (JPG) site. I am also enclosing our amended proposed approach.

As we noted in an earlier letter, ASTM withdrew *Standard Test Method for Distribution Ratios by the Short-Term Batch Method* (ASTM D4319-93). Subsequently, we proposed to use the laboratory's (TestAmerica, Inc., Earth City, Missouri) standard operating procedure (SOP), *K_d Leaching Procedure*, to complete the site-specific K_d tests that had been based on ASTM D4319-93. However, ASTM released *Standard Test Method for Distribution Coefficients of Inorganic Species by the Batch Method* (ASTM C1733-10) in 2010. Therefore, with your concurrence, we plan to use an SOP that TestAmerica will develop based on ASTM C1733-10 instead of ASTM D4319-93 for the K_d testing of JPG soil samples.

We would like to discuss any potentially remaining questions and issues you might have regarding the Army's K_d and desorption testing so that we can commence the sample recollection as soon as possible. To minimize overall schedule delays, sample recollection should commence in September 2011. We assume sample recollection and testing by TestAmerica will take at least two months to complete once the NRC has agreed with our proposed sampling plan.

You may reach me by telephone at (210) 466-0368 or by email at robert.cherry@us.army.mil.

Sincerely,

Robert N. Cherry, Jr.
Radiation Safety Staff Officer

Enclosures

Responses to 10 March 2011 Letter from Mr. Dominick Orlando, U.S. Nuclear Regulatory Commission, Materials Decommissioning Branch, Division of Waste Management and Environmental Protection, Office of Nuclear Materials Safety and Safeguard

NRC Concerns:

Nuclear Regulatory Commission Concern	Army Installation Management Command (IMCOM) Response
"Representativeness of rainwater to be used in the K_d study for subsurface soil samples (below 1 or 2 feet) as differences are expected in pH and alkalinity levels in rainwater at or near ground surface verses rainwater that has mixed with subsurface minerals with depth over time." ***NRC Comments on Army Response (Summarized from 10 March 2011 Letter)***–NRC provided three reasons in the 10 March 2011 letter explaining concerns with the hypothesis that alkalinity levels in the soil mixtures, which were measured for 48 hours, would continue to rise due to contact with the soil during the planned 45-day K_d test. They also expressed concerns about the differences in pH levels observed in rainwater and groundwater as shown in the Army's 14 January 2011 letter. Based on their concerns, NRC suggested that the Army collect representative groundwater samples with which to conduct the K_d tests for subsurface samples.	The Army plans to collect groundwater from JPG-DU-06O in accordance with procedures defined in Field Sampling Plan (FSP) Addendum 5, Section 5 (U.S. Army 2008). In addition, the Army will recollect rainwater due to the period of time that has lapsed since rainwater was last collected in January 2010. Rainwater will be collected from the same station where it was collected previously, which is situated on JPG property to the west of the Depleted Uranium (DU) Impact Area. The reasons for selecting JPG-DU-06O, along with other information about groundwater/rainwater collection, are provided in the enclosure entitled "Army's Plan for Sample Recollection and K_d/Desorption Testing."
"Potential degradation that occurred since the time when the first 24 soil samples for the K_d study were collected in October 2008 with potential variation occurring in pH, organic carbon, or total organic carbon." ***NRC Comments on Army Response (Summarized from 10 March 2011 Letter)***–Based on the Army's re-analysis of six samples as shown in the Army's 14 January 2011 letter, NRC noted an estimated 70 percent increase in the mean total organic carbon (TOC) present in samples that "…could affect radionuclide sorption to the soil samples by increasing the concentration of sorption sites in the soil samples." NRC also expressed concerns about the decrease in average pH by	Despite the fact that all of the soil samples were stored at 4+/-2°C in coolers immediately after collection and refrigerated since being received at the laboratory, differences were observed in TOC and pH levels as documented in the Army's letter to NRC dated 14 January 2011 (U.S. Army 2011). The Army believes it would be more prudent to recollect all of the soil samples needed for the K_d study rather than collecting/testing only a subset of samples to reduce further delays should differences be observed after the conclusion of the tests. Although not specifically identified as a concern by NRC, the Army also plans to recollect soil samples collected from the glacial till stratigraphic layer as they were collected in December 2009. Additional details about the soil re-sampling are provided in

Nuclear Regulatory Commission Concern	Army Installation Management Command (IMCOM) Response
approximately 0.9 pH units that also could affect the chemical speciation and mobility of uranium. As such, NRC suggested that the Army "…collect samples from a subset of the locations sampled in 2008 (e.g., approximately 10%) and perform adsorption and desorption tests to demonstrate whether the samples collected in 2011 yield similar results to the samples collected in 2008."	the enclosure entitled "Army's Plan for Sample Recollection and K_d/Desorption Testing."
"Potential losses of uranium adhering to filter container walls during the K_d study." ***NRC Comments on SAIC Response***–"The JPG response appears to be reasonable."	No response required.

NRC Observations:

Nuclear Regulatory Commission Observation	Army Installation Management Command (IMCOM) Response
In a July 23, 2009 letter, JPG indicated that information from desorption testing will primarily be used in evaluating the amount of DU near the source location that is available to dissolve or desorb into groundwater. JPG also indicated that values associated with adsorption testing will be used to model uranium transport through clean soil. The licensee has indicated that it plans to use TestAmerica's standard operating procedure for K_d studies, which is based on the withdrawn American Society for Testing and Materials (ASTM) test D4319-93. ASTM D4319-93 indicates that it applies only to situations in which only sorptive processes (adsorption and ion exchange) are operable for the species of interest. Thus, the use of the term 'K_d' may be misleading when applied to the results of the desorption tests, which are expected to involve dissolution. The NRC staff agrees that useful information may be obtained by observing the release of	The Army agrees that desorption tests should not be interpreted to represent uranium mobility in soils and will report both solid and liquid concentration data as measured and reported by the laboratory during the desorption testing. Further, the Army will not use results from the "desorption" tests to represent or calculate site-specific K_d values. In light of elevated uranium activities observed in some soil samples in the DU trench and under penetrators, the Army feels that site-specific empirical data obtained through laboratory desorption testing is needed to understand desorption processes occurring in the soil at JPG. It appears that rainwater infiltrating through the soil column may be desorbing uranium from surface/shallow subsurface soil and transporting it deeper into the soil column. The goal is to collect three samples for a qualitative evaluation. Additional details about the soil locations for these samples are provided in the enclosure entitled "Army's Plan for Sample Recollection and K_d/Desorption

Responses to 10 March 2011 Letter from Mr. Dominick Orlando, U.S. Nuclear Regulatory Commission, Materials Decommissioning Branch, Division of Waste Management and Environmental Protection, Office of Nuclear Materials Safety and Safeguard

Nuclear Regulatory Commission Observation	Army Installation Management Command (IMCOM) Response
uranium from contaminated soil samples, and that transport through clean soil should be based on the results of adsorption, rather than desorption, tests. However, the NRC staff does not expect that the desorption tests will be interpreted to represent uranium mobility in site soils. The NRC staff recommends that the licensee report solid and liquid concentrations measured during "desorption" tests without representing the ratio as a 'K_d' value.	Testing." As mentioned above, the Army plans to use an SOP developed by TestAmerica based on the new method for conducting K_d tests: ASTM C1733-10, *Standard Test Method for Distribution Coefficients of Inorganic Species by the Batch Method*. The new method does not include a protocol for measuring desorption. In the absence of an accepted method for conducting desorption testing, the Army plans to exclude the steps from ASTM C1733-10 where the contact solution is spiked with uranium.
Page 2 refers to the "previously documented testing limits" or 160 picocuries per gram (pCi/g). This value is discussed in the licensee's November 6, 2008, letter. As indicated in that letter, the basis of this value is from experiments performed with samples from the Hanford site in Richland, Washington. Any applicability of this value to samples from JPG would need to be demonstrated by the licensee. The NRC staff recommends that geochemical modeling, which the licensee indicates it plans to use, may be used in conjunction with site observations as support for solubility limits applicable to various site conditions at the JPG site.	The concept of testing limits was previously introduced to address NRC's concerns with using soil samples with high activities of uranium. However, the Army has modified the approach in three ways to address this issue: limit the number of desorption tests (conducted on samples with high uranium activities), disregard desorption testing in the calculation of site-specific K_d values, and conduct K_d tests using soils not impacted by DU (i.e., collected from background locations more than 3.5 miles from the DU Impact Area and deeper subsurface soils away from DU trenches). In addition, the Army will conduct geochemical modeling using site-specific data to ascertain solubility information.
On page 2, it is unclear what is meant by "solubility limits that may be ascertained as a boundary between adsorption/desorption." Specifically, it is unclear what is meant by solubility forming a "boundary" between adsorption and desorption.	Similar to the discussion in response to NRC Observation 2, the discussion concerning the "boundary" between adsorption and desorption was previously introduced with regard to NRC's concerns with using soil samples with high uranium activities. As such, the "boundary" is no longer relevant.
Page 3 indicates alkalinity was measured in mixtures of soil and water using Environmental Protection Agency drinking water method E310.1. The EPA method indicates that the sample should be refrigerated at 4°C before use in a closed container with a minimum amount of air trapped in the container. These precautions minimize the equilibration of	The Army confirmed with SAIC's sample manager that groundwater samples analyzed for alkalinity were collected in 500-mL polyethylene bottles and stored at 4+/-2°C in coolers immediately after collection. Due to the limited size of these containers, they were usually filled nearly completely with minimal air, although the sampling protocol does not require the collection of "zero-headspace"

Nuclear Regulatory Commission Observation	Army Installation Management Command (IMCOM) Response
the alkalinity in the sample with atmospheric carbon dioxide. Indicate whether these aspects of the test procedure were followed.	samples such as are required for volatile organic compounds (VOCs). In addition, the Army's contractor (Science Applications International Corporation [SAIC]) confirmed with the laboratory manager that all groundwater samples analyzed for alkalinity were stored in the same container in which they were originally collected at 4+/-2°C in dark refrigerators shortly after receipt by the laboratory until they were analyzed. Upon additional investigation by SAIC with the laboratory performing this analysis, it was discovered that the laboratory did not actually use U.S. Environmental Protection Agency's (USEPAs) Method 310.1 for the analysis of alkalinity in these samples. Instead, they used Method SM 2320B from the *Standard Methods for the Examination of Water and Wastewater* because USEPA withdrew Method 310.1 in 2007. Additional information about the withdrawal can be found in USEPA's Final Ruling for 40 Code of Federal Regulations (CFR) Part 122, 136, et al., which is entitled *Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act; National Primary Drinking Water Regulations; and National Secondary Drinking Water Regulations; Analysis and Sampling Procedures*. It is more commonly known as the Method Update Rule (MUR) and was enacted on 12 March 2007. The rule approved new methods; modified method and analytical requirements; withdrew some outdated USEPA methods; and changed some sample collection, preservation, and holding time requirements under the Clean Water Act and Safe Drinking Water Act. It should be noted that the laboratory confirmed they followed Method SM 2320B, but this method does not appear to include the requirements from E 310.1 regarding refrigeration or air entrapment. Further, all samples were analyzed within the required hold time (28 days), thereby minimizing the potential for equilibration of the alkalinity in the samples with atmospheric carbon dioxide.

References

U.S. Army. 2008. Field Sampling Plan Addendum 5, Depleted Uranium Impact Area Site Characterization – Data Quality Objectives for Groundwater, Surface Water, and Sediment Sampling and Analysis, Jefferson Proving Ground, Madison, Indiana. Final. January.

U.S. Army. 2011. Letter to Mr. Dominick Orlando, Materials Decommissioning Branch, Division of Waste Management and Environmental Protection, Office of Nuclear Materials Safety and Safeguard, Rockville, Maryland from Joseph N. Skibinski, Project Manager, SAIC, McLean, Virginia. January 14.

Army's Plan for Sample Recollection and K_d/Desorption Testing

Pending concurrence from NRC on the following proposed approach, the Army plans to mobilize to JPG to recollect rainwater, groundwater, and soil samples for K_d and desorption testing. Rather than develop and issue another FSP addendum for this recollection effort, this section summarizes the relevant aspects of existing FSP addenda that will be used for the recollection in the interest of time. The following paragraphs and tables provide references to existing FSP addenda, identify proposed sampling locations, and summarize other changes from previously submitted FSP addenda.

Sample Recollection Overview

TestAmerica will revise and follow their SOP based on ASTM C1733-10 for the site-specific K_d testing. The SOP also will include provisions for conducting desorption testing. The re-sampling includes 21 tests with background soils, 6 tests with deeper (uncontaminated) soils for site-specific K_d testing, and 3 desorption tests with uranium-contaminated soil collected from under DU penetrators. Leachant/contact liquid (rainwater or groundwater) to be used for the K_d and desorption tests will be collected and supplied to the laboratory by SAIC. TestAmerica will spike the liquid with uranium at known concentrations prepared with chemically pure reagents. Rainwater will be used as the leachant/contact liquid with the tests performed using surface soil (24 K_d tests + 3 desorption tests). Groundwater will be used with deeper soil collected from the glacial till stratigraphic layer (6 K_d tests). Table 1 includes the tests and leachant/contact liquids by soil type.

Table 1. Summary of Site-Specific K_d/Desorption Testing and Contact Liquid by Soil Type

Test	Avonsburg/ Cobbsfork	Cincinnati/ Rossmoyne	Grayford/ Ryker	Glacial Till	Total
K_d	Soil from 9 background locations with rainwater for contact liquid	Soil from 9 background locations with rainwater for contact liquid	Soil from 3 background locations with rainwater for contact liquid	Soil from 6 locations with groundwater for contact liquid	27
Desorption	Soil from under 1 penetrator with rainwater for contact liquid	Soil from under 1 penetrator with rainwater for contact liquid	Soil from under 1 penetrator with rainwater for contact liquid	Not applicable	3
Total	10	10	4	6	30

Collection of Leachant (Rainwater/Groundwater)

The majority of the DU penetrators and corrosion that has occurred to date is present at or near ground surface; thus, rainwater is considered a more representative leachant. However, as the DU corrosion products dissolve in rainwater and migrate to deeper depths over the next 1,000 years, groundwater also is a representative leachant. Consequently, the Army will collect both rainwater and groundwater for use as the contact liquid/leachant.

Groundwater will be collected in accordance with procedures defined in FSP Addendum 5 (U.S. Army 2008a) including procedures for field instrumentation and measurements; well purging; equipment usage and decontamination; field operations documentation; sample handling, packaging, and shipping; investigation-derived waste (IDW); and, radiological responsibility and licensing. As discussed in the following bullets, the Army plans to collect groundwater from

JPG-DU-06O as water from this well represents average conditions for groundwater in the JPG DU Impact Areas and sampling results confirm that DU has not impacted groundwater in this well:

- This well is situated south of Big Creek in an area that is approximately 70 feet higher in elevation than the elevation of Big Creek within the DU Impact Area. With groundwater migration generally in a northerly direction toward Big Creek in this area and the trench situated to the west/northwest, JPG-DU-06O is sidegradient or upgradient of potential DU sources.
- The screen in this well intersects groundwater in the shallowest hydrostratigraphic unit (overburden). Thus, this unit is the most accessible groundwater for potential future human contact.
- The historic groundwater recharge in this well should produce all of the contact liquid required for K_d testing of subsurface soils within the time needed for soil sampling while allowing time for the well to recharge. Well purging for past sampling events indicates that this well has a relatively high yield when compared to other groundwater wells at JPG and particularly as compared to other overburden wells.
- Concentrations in JPG-DU-06O across four quarters of sampling ranged from 2.11 to 4.00 pCi/L, including filtered and unfiltered sample results, with an overall average total uranium activity of 2.9 pCi/L. Uranium concentrations across all wells, including filtered and unfiltered samples, ranged from 0.1 to 47 pCi/L with an overall mean of 2.1 pCi/L. Therefore, JPG-DU-06O does not appear to have been impacted by DU.
- The average levels of alkalinity, anion, and cation results for JPG-DU-06O are within one standard deviation of the mean concentration for all groundwater samples collected during sampling for all four quarters for alkalinity, anions, and cations. Therefore, the water quality in JPG-DU-06O is representative of groundwater within the DU Impact Area.

In addition, the Army will recollect rainwater at JPG using plastic sheeting directed into a plastic drum set up at the same station where it was collected previously. It is situated on JPG property to the west of the DU Impact Area. Rainwater will be collected in accordance with procedures defined in FSP Addendum 7, Section 5.3 (U.S. Army 2008b), including procedures for field instrumentation and measurements; equipment usage and decontamination; field operations documentation; sample handling, packaging, and shipping; IDW; and radiological responsibility and licensing.

SAIC will collect enough rainwater or groundwater for the laboratory to prepare soil/water mixtures at the recommended 25:1 (liquid to solid mass) ratio to enable sampling of each mixture for uranium analysis of the supernatant at predetermined time intervals, including 3, 7, 10, 14, 21, 28, 35, and 45 days. Thirty-five liters (L) of water will be placed directly into each of three 20-L (5.3-gal) containers (two for rainwater and 1 for groundwater). In addition to the 20-L containers, 1-L water samples will be provided for ^{234}U, ^{235}U, and ^{238}U activity analyses and one 500-milliliter (mL) sample container will be collected for determination of major cation (calcium, potassium, magnesium, sodium) analysis and another 500 mL container for anion (chloride, nitrate, and sulfate) analysis. Sample containment, preservation, and analytical methods for groundwater and rainwater to be used for leachant/contact liquid in K_d and desorption testing will be consistent with requirements defined in FSP Addendum 7, Table 8-3

(U.S. Army 2008b). Upon receipt of water from JPG, TestAmerica will analyze water aliquots for total and isotopic uranium using methods outlined in ASTM D3972-90M. Nonradiological water parameters to be measured by TestAmerica include:

- TOC (E 415.1)
- Total carbon (SW9060A)
- Total iron (SW 6010)
- Total manganese (SW 6010)
- Major cations (SW 6010)
- Major anions (E 300.0)
- Alkalinity (SM 2320B).

Collection of Soil

As discussed above and shown in Table 1, the Army plans to recollect soil for K_d and desorption testing. The Army plans to collect these samples from locations where samples were previously collected or, in the case of sampling under penetrators, as close as possible to previous sampling locations. The coordinates (northings and eastings) were recorded for the previous soil sampling event with a global position system (GPS) unit. The sampling team will return as close as possible to the original sampling locations, which should be within approximately 1 meter given the accuracy of typical GPS units. For the three samples to be recollected for desorption testing, the penetrators were removed in October 2008. Thus, it will not be possible to recollect soil under those specific penetrators. Through the combined use of a GPS unit and a sodium iodide (NaI) gamma scintillation radiation detector, it should be possible to return in very close proximity to the original sampling positions and the NaI detector should be able to locate new penetrators for re-sampling. Coordinates for all final sampling locations will be included in future reports with analytical results. Table 2 shows the total uranium activities for the proposed locations and Figure 1 shows the respective locations.

Surface soil will be collected in accordance with procedures defined in FSP Addendum 7 (U.S. Army 2008b) and glacial till samples will be collected in accordance with procedures defined in FSP Addendum 8 (U.S. Army 2009), including procedures for sampling; decontamination; field operations documentation; sample handling, packaging, and shipping; IDW; and radiological responsibility and licensing. Rather than re-collecting samples from multiple depths as was done in October 2008 and as described in the respective FSP Addendum 7 (U.S. Army 2008b), the soil for the K_d and desorption tests will be collected from ground surface to approximately 0.5 feet below land surface (BLS) because the objective is to collect enough soil for the K_d tests rather than repeat the entire soil characterization study. Similarly, subsurface soils will be collected from similar depths in the glacial till stratigraphic layer as was done in December 2009 and as described in FSP Addendum 8 (U.S. Army 2009). ASTM C1733-10 recommends using 1- to 5-gram portions of soil mixed with the contact liquid for each test for a total of 1.2 kg of soil to be collected for each test. Soil will be recollected from background areas with Avonsburg/Cobbsfork, Cincinnati/Rossmoyne, and Grayford/Ryker soil types and from the glacial till stratigraphic layer. Soil also will be recollected from areas that were previously sampled under three penetrators from areas with the Avonsburg/Cobbsfork, Cincinnati/Rossmoyne, and Grayford/Ryker soil types.

Table 2. Proposed Sample Listing for K_d and Desorption Testing

Soil Types	Test	Site I.D. / Depth BLS (feet)	Concentration (pCi/g)
Avonsburg/Cobbsfork	K_d	JP-SAC-001 / 0-0.5	1.45+/-0.327
Avonsburg/Cobbsfork	K_d	JP-SAC-002 / 0-0.5	1.32+/-0.300
Avonsburg/Cobbsfork	K_d	JP-SAC-003 / 0-0.5	1.50+/-0.340
Avonsburg/Cobbsfork	K_d	JP-SAC-004 / 0-0.5	1.30+/-0.296
Avonsburg/Cobbsfork	K_d	JP-SAC-005 / 0-0.5	1.77+/-0.400
Avonsburg/Cobbsfork	K_d	JP-SAC-006 / 0-0.5	1.42+/-0.323
Avonsburg/Cobbsfork	K_d	JP-SAC-007 / 0-0.5	1.36+/-0.310
Avonsburg/Cobbsfork	K_d	JP-SAC-008 / 0-0.5	1.59+/-0.362
Avonsburg/Cobbsfork	K_d	JP-SAC-009 / 0-0.5	1.55+/-0.346
Avonsburg/Cobbsfork	Desorption	JP-PNAC-001 / 0-0.5	15,095+/-159
Cincinnati/Rossmoyne	K_d	JP-SCR-001 / 0-0.5	1.57+/-0.354
Cincinnati/Rossmoyne	K_d	JP-SCR-002 / 0-0.5	1.08+/-0.250
Cincinnati/Rossmoyne	K_d	JP-SCR-003 / 0-0.5	1.64+/-0.366
Cincinnati/Rossmoyne	K_d	JP-SCR-004 / 0-0.5	1.55+/-0.350
Cincinnati/Rossmoyne	K_d	JP-SCR-005 / 0-0.5	1.68+/-0.379
Cincinnati/Rossmoyne	K_d	JP-SCR-006 / 0-0.5	1.61+/-0.362
Cincinnati/Rossmoyne	K_d	JP-SCR-007 / 0-0.5	1.81+/-0.402
Cincinnati/Rossmoyne	K_d	JP-SCR-008 / 0-0.5	1.53+/-0.343
Cincinnati/Rossmoyne	K_d	JP-SCR-009 / 0-0.5	1.79+/-0.400
Cincinnati/Rossmoyne	Desorption	JP-PNCR-001 / 0-0.5	27,496+/-190
Grayford/Ryker	K_d	JP-SGR-001 / 0-0.5	1.15+/-0.266
Grayford/Ryker	K_d	JP-SGR-002 / 0-0.5	1.56+/-0.351
Grayford/Ryker	K_d	JP-SGR-003 / 0-0.5	1.47+/-0.330
Grayford/Ryker	Desorption	JP-PNGR-001 / 0-0.5	4,180+/-72
Pre-Wisconsinan Till	K_d	JP-KAC-011 / 10-16	1.96 +/- 0.359
Pre-Wisconsinan Till	K_d	JP-KAC-012 / 10-18	2.16 +/- 0.400
Pre-Wisconsinan Till	K_d	JP-KAC-013 / 10-16	1.64 +/- 0.310
Pre-Wisconsinan Till	K_d	JP-KCR-011 / 10-16	3.48 +/- 0.520
Pre-Wisconsinan Till	K_d	JP-KCR-012 / 8-14	0.920 +/- 0.220
Pre-Wisconsinan Till	K_d	JP-KGR-005 / 6-10	1.87 +/- 0.350

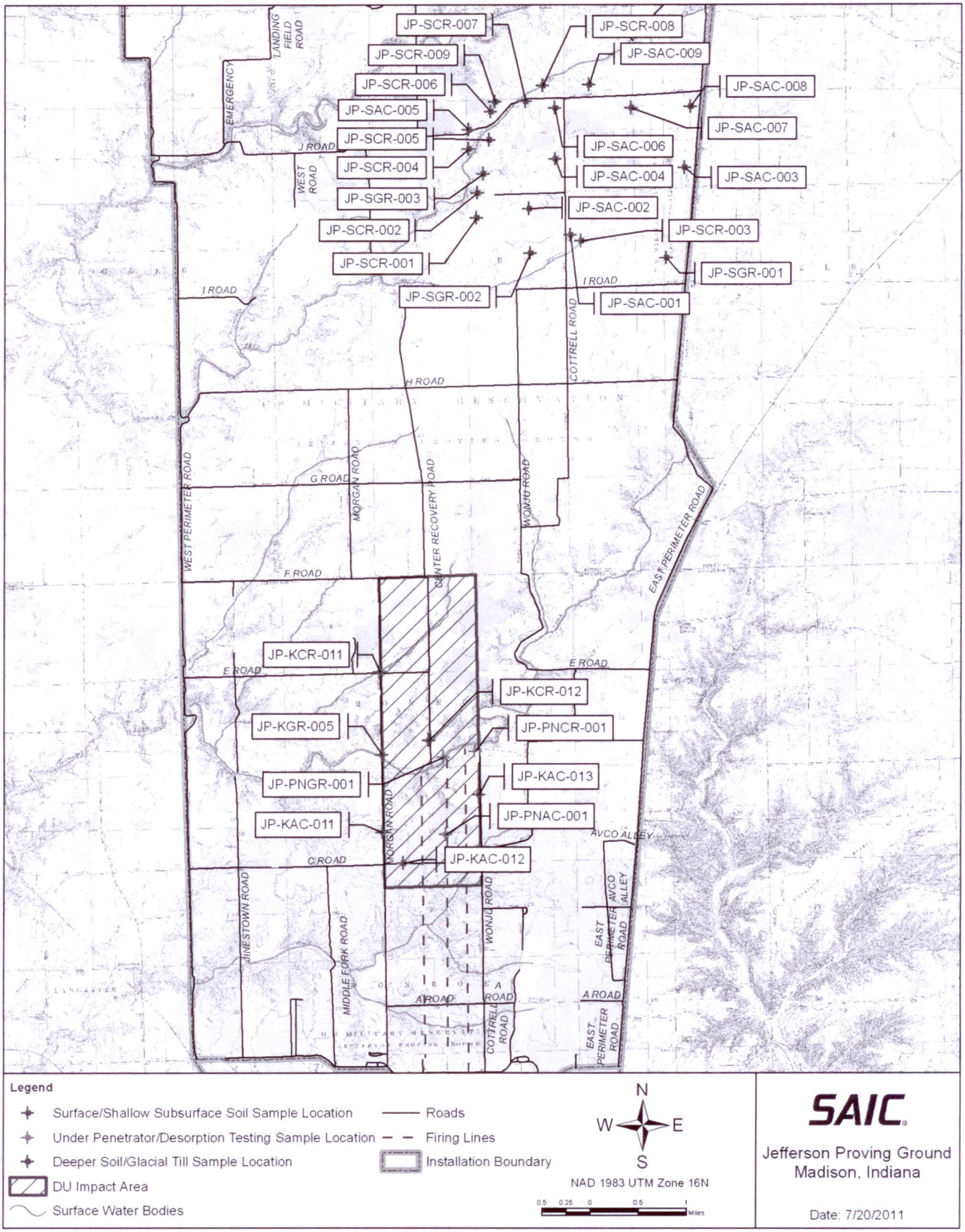

Figure 1. Proposed Sample Locations for K_d and Desorption Testing

Upon receipt of soil from JPG, TestAmerica will analyze subsamples taken from soil for total and isotopic uranium using ASTM D3972-90M. The Army proposes to air dry the soil samples, use a tumbler to disaggregate the soil samples, and use a sieve to remove particles greater than 2 millimeters in size. Nonradiological soil and water parameters to be measured by TestAmerica include:

- Moisture content (ASTM D2216-05)
- Soil pH (ASTM D4972-01/EPA 9045C)
- Particle size distribution (ASTM D422-63)
- TOC (SW9060A)
- Total carbon (SW9060A)
- Total iron (SW 6010)
- Total manganese (SW 6010).

K_d/Desorption Testing

Recollected soil will be mixed with the contact solution (rainwater or groundwater) until steady state is achieved (i.e., consistency in uranium levels measured in three consecutive leachate solutions). For the 27 K_d tests, the contact solution (rainwater or groundwater) will be spiked with uranium concentrations ranging from approximately 1 to 10 pCi/L to simulate the range of concentrations expected in water at JPG. The contact solution will not be spiked for the three desorption tests. For each soil sample, the laboratory will prepare soil/water mixtures at the recommended 25:1 (liquid to solid mass) ratio to enable sampling of each mixture for uranium analysis of the supernatant at predetermined time intervals, including 3, 7, 10, 14, 21, 28, 35, and 45 days. The laboratory will quantify total and isotopic uranium concentrations in the supernatant/contact liquids using solid waste method SW 6020 with inductively coupled plasma-mass spectrometry (ICP-MS). ICP-MS is preferable to alpha spectrometry because of the lower detection limits that will be needed, since uranium concentrations will diminish during the testing period as uranium sorbs to soil particles. To ensure that the longer desorption processes have reached equilibrium, the duration of the contact between the leachant and the soil has been extended up to 45 days, which well exceeds the recommended 14-day duration in ASTM D 4319-93. TestAmerica's SOP will describe the procedures that laboratory personnel will follow when completing the 27 K_d and 3 desorption tests using an SOP that will be developed based on ASTM C1733-10.

References

U.S. Army. 2008a. Field Sampling Plan Addendum 5, Depleted Uranium Impact Area Site Characterization – Data Quality Objectives for Groundwater, Surface Water, and Sediment Sampling and Analysis, Jefferson Proving Ground, Madison, Indiana. Final. January.

U.S. Army. 2008b. Field Sampling Plan Addendum 7, Depleted Uranium Impact Area Site Characterization: Soil Sampling and Analysis, Corrosion Study, Partition Coefficient Study, Modeling Overview, and Slug Testing, Jefferson Proving Ground, Madison, Indiana. Final. August.

U.S. Army. 2009. Field Sampling Plan Addendum 8, Depleted Uranium Impact Area Site Characterization: Soil Sampling and Analysis Using Direct Push Technology, Partition Coefficient Study for Glacial Till Stratigraphic Layer, Jefferson Proving Ground, Madison, Indiana. Final. October.