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FINAL

RFI/RI WORK PLAN

ROCKY FLATS PLANT
400/800 AREA
(OPERABLE UNIT NO. 12)

U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant
Golden, Colorado

ENVIRONMENTAL RESTORATION PROGRAM

DECEMBER 1992

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Concentrations of the three select metals in soils within and near OU12 were typically less than upper tolerance limits or maximum concentrations in background soils Beryllium concentrations, which ranged from less than 0 15 to 2 0 mg/kg, in soils within and near OU12 were less than half of the upper tolerance level of 4.7 mg/kg calculated from background soil samples

Chromium was detected in all but two samples within and near OU12 at concentrations less than the upper tolerance limit of 20 mg/kg calculated for the background soil samples. The two exceptions of 27 and 34 mg/kg were detected at locations 13489 and 14289, respectively The only reliable lithium detection of 14 mg/kg at location 17989 was above the upper tolerance limit of 8 1 mg/kg calculated from background samples south of RFP, however it was below the minimum concentration of 16 mg/kg observed in background samples collected north of the RFP

Gross alpha concentrations in soils within and near OU12 were less than the upper tolerance limit of 38 pCi/g calculated for gross alpha concentrations detected in background soils Gross beta concentrations in OU12 soils and in soils nearby were within the range of background concentrations of 3 to 42 pCi/g. Three detections were above, but close to, the upper tolerance limit of 37 pCi/g The highest plutonium-239/240 concentration detected in soils within and near OU12 was 15.86 pCi/g A background concentration for plutonium-239 is available but not applicable for a comparison because it is only for one isotope Concentrations of uranium-233/234 and uranium-238 were typically greater than upper tolerance limits of 0 66 and 0 68 pCi/g calculated for each of these compounds, respectively, from concentrations in background soils However, the concentrations of uranium-233/234 and uranium-238 in soils within and near OU12 were within the range of concentrations observed in background soils. The majority of tritium concentrations for soils within and near OU12 were less than the calculated upper tolerance limit of 410 pCi/g and were within the range of tritium concentrations detected in background soils Exceptions were in soils at 13689 and 14689 located in the northeast portion of OU12 and north of OU12, respectively

Ground Water

As stated in the previous section, alluvial ground water data near OU12 were limited to two monitoring wells, one east and one south of the OU12 boundary (Table 2.7 and 2.8) Metals concentrations in ground water samples from these wells were generally greater than calculated upper tolerance limits and maximum concentrations detected in alluvial ground water samples from background locations (EG&G, 1990a) Exceptions include mercury which was not detected in background samples above a detection limit of 0 0002 mg/l and was only detected during one sampling event in well 0187 at 0.00028 mg/l. Selenium and strontium were also detected at low concentrations in well 0187 close to or below, respectively, the detection limits of 0 05 and 1 0 mg/l, used for the background samples. Zinc was detected in ground water from well 0187 at concentrations within the range of observed background concentrations from the alluvial ground water samples

The radionuclides, gross alpha, gross beta, uranium-233/234, uranium-235/236, and uranium-238 were detected in wells 0187 and 17989 at concentrations greater than the calculated upper tolerance limit or the maximum concentration detected in background water samples The other select radionuclides analyzed in ground water from well 0187 were detected within or below concentration ranges observed in background alluvial ground water samples

The major ions bicarbonate, chloride, nitrate/nitrite, and sulfate were analyzed in both ground water from wells 0187 and 17989 and in background well locations Concentrations of these ions in well 17989 and in well 0187, with the exception of nitrate/nitrite, were greater than the upper tolerance limit calculated from the background ground water samples Nitrate/nitrite concentrations in well 0187 were below this limit and also were within the range of concentrations detected in the background samples. Total dissolved solids (TDS) concentrations in 17989 were greater than those observed in background samples TDS concentrations in 0187 were within the range of background TDS concentrations

2.5 SITE CONCEPTUAL MODEL

On the basis of the known site physical conditions and the potential contamination sources described in the preceding sections, a conceptual model of exposure pathways for OU12 has been developed for use in the evaluation of the potential risks presented to human health and the environment

The primary purpose of a conceptual model is to aid in identifying exposure pathways by which human and biotic receptors may be exposed to site contaminants. The EPA defines an exposure pathway as " a unique mechanism by which a population may be exposed to chemicals at or originating from the site ." (EPA, 1989b). As shown in Table 2.10, an exposure pathway includes a contaminant source, a release mechanism, a transport medium or migration pathway, an exposure route, and a receptor An exposure pathway is not complete unless all of these elements are present. Each individual element is described in more detail in the individual sections referenced below.

- Contaminant Source (Section 2 5 1) - For the OU12 conceptual model, the contaminant sources are the media potentially impacted by historical releases of chemicals from each IHSS. These are secondary source media and may include soil, sediment, vadose water, and ground water throughout OU12.

- Release Mechanism (Section 2 5 2) - A release mechanism is a physical and/or chemical process by which contaminants are released from the source The conceptual model for OU12 identifies historical mechanisms which released contaminants directly from historical sources at the time of the actual spills or releases, and primary release mechanisms which release contaminants directly from the current contamination (or secondary) sources Secondary mechanisms which release contaminants from one transport media to another are also identified. Primary release mechanisms for OU12 may include wind erosion, volatile emissions, infiltration, dissolution, leaching, tracking, bioaccumulation/ bioconcentration, and storm water runoff. Secondary mechanisms may include percolation, recharge, discharge, seepage, pumpage, irrigation volatilization, and dry deposition

- Transport Medium (Section 2 5 3) - A transport medium is the environmental medium into which contaminants are released from the source, and from which contaminants are in turn released via an exposure route. Potential transport media for OU12 include flora, fauna, vadose water, ground water, surface water, and air

- Exposure Route (Section 2 5 4) - Exposure routes are avenues through which contaminants are physiologically incorporated by a receptor Exposure routes for receptors at OU12 include ingestion, direct dermal contact, and inhalation.

- Receptor (Section 2 5 5) - Receptors are human or environmental populations that are exposed to the contamination released from a site. Environmental receptors include biota (both flora and fauna) that may be indigenous to the primarily industrial OU12 area.

The conceptual model shown in Figure 2-39 provides a contaminant source characterization and an overview of all the potential exposure pathways that may exist at OU12 The pathways are shown pictorially in Figure 2-40 Some pathways have a higher potential for occurrence than others; more likely exposure pathways are identified in Table 2-10 and discussed by evaluating the fate and mobility of the source contaminants in the various transport media For the OU12 area, many IHSSs have been isolated from transport media by concrete or asphalt pavement, which may effectively eliminate any exposure to re-suspended dust or volatile organic compounds In areas where infiltration is possible, sparingly soluble compounds, such as plutonium and trivalent chromium [Cr (III)], will remain bound to soils, rather than being mobilized by infiltration and transported in ground water Similarly, some ground water originating in the OU12 area may be intercepted by the Building 881 Hillside French drain, which is currently under construction, or the interceptor trenches at the Solar Ponds (OU4)

2.5.1 Contaminant Source

As shown in Figure 2-39, the primary sources of contamination at OU12 are considered to be the potential or documented releases that occurred at an IHSS. For the purpose of the conceptual site model for OU12, the 10 IHSSs are considered one historical source because of their proximity and overlapping boundaries, the similar nature and small size of many of the reported releases, and the surficial or shallow nature of the impacts. The potential impacted media include air, surface water, sediment, ground water, and soil. Since the historical release events, contaminants released to air and surface water have dissipated. Soil and sediment are, therefore, considered the current, or secondary, contaminant sources in the OU12 model The following sections describe the characteristics of the historical and current contaminant sources.

2.5.1.1 Historical Source Characterization

The 10 IHSSs that comprise OU12 have been described in detail in Section 2.1. To summarize the discussion presented in that section, the 10 IHSSs include:

- Loading docks at Buildings 447 and 444 (IHSSs 116 1 and 116 2) where solvents and uranium wastes were stored,

- Fiberglass application areas in the vicinity of Building 664 (IHSSs 120.1 and 120 2),

- A storage area related to the conversion of Building 881 from enriched uranium components production to a non-radioactive metals fabrication facility (IHSS 147 2),

- General soils contamination in the 400 area, referred to as the Radioactive Site South Area (IHSS 157 2),

- A sulfuric acid spill adjacent to Building 443 (IHSS 187),

- The area adjacent to two nitric acid storage tanks (IHSS 189), east of Building 444, where nitric acid spills have been documented, and

- Cooling water ponds located in the vicinity of Building 444 (IHSSs 136 1 and 136 2) which contained cooling tower blowdown from Buildings 444 and 447

Each of these sites has been identified because of documented or suspected spills or leaks of contaminants during storage or during normal operations In each documented case, the spills or leaks were generally limited in extent The documented or suspected releases occurred over an approximate 40 year period, and may have potentially impacted soils, sediments and ground water remaining within the OU12 area Most of the spills or leaks are thought to have impacted sediments and surface and shallow soils The cooling water ponds have impacted shallow subsurface soils Although surface water and air were also potentially impacted by historical releases, they are not considered as current sources, but instead as transport media and migration pathways

2 5.1 2 Current Contaminant Source Characteristics

The historical releases described above have impacted soils and sediments within OU12 As shown in Figure 2-39, these media are considered the current contaminant sources The physical and chemical characteristics of the contamination in these media have been discussed in detail in Section 2 4 The contaminants comprise five general types· radioactive materials, including depleted uranium and plutonium; chlorinated organic solvents used for cleaning parts and components; metals, including lithium, beryllium, and chromium; acid and/or neutralized acid byproducts; and chemicals such as polyester resin related to fiberglassing operations The behavior of these contaminant types is described below No analytical results are available specifically for the OU12 IHSSs because no previous sampling has been conducted Section 6.3 provides the media sampling and analysis rationale for the OU12 Field Sampling Plan.

Radionuclides present in the OU12 area include both naturally occurring and man-made isotopes These elements may be of concern due to both their radioactivity and chemical toxicity The uranium isotopes occur naturally in soils and sediments, and exist in economically recoverable quantities near the Rocky Flats Plant. Their mobility is variable and is based primarily on environmental oxidation-reduction and pH conditions.

The valence states of uranium, U(IV) and U(VI), are stable under naturally occurring environmental conditions The U(IV) valence state is relatively insoluble under slightly acidic to basic pH, and is stable under reducing conditions. The U(VI) valence state predominates under oxidizing conditions and is relatively soluble. Uranium released in its elemental form or as U(IV) oxides will be associated with soils or sediments and transported as particulates Oxidation of U(IV) over time may result in conversion to the soluble U(VI) and subsequent mobilization and transport in surface and ground water.

Plutonium is a transuranic actinide element, and does not occur naturally in the environment. Sensitive analytical techniques allow measurement of background concentrations of these elements which are the result of atmospheric testing of nuclear weapons Plutonium forms insoluble hydroxide and oxide solids under neutral to basic pH conditions, limiting its mobility in the subsurface Similar to the transition metals, however, plutonium may be transported in association with particulates in surface water or air, or possibly as colloids in ground water

The chlorinated organic solvents are generally characterized by relatively high solubility and volatility, and relatively low affinity for solids Therefore, these chlorinated solvents are generally readily mobilized from shallow soil by volatilization and infiltration. In cases where soils contain significant levels of organic carbon, or are high in clay, chlorinated compounds can be sorbed to these soils If dissolved in surface water or ground water, these compounds are readily transported In surface water systems, these solvents are volatilized to the atmosphere where they are photo-oxidized Although the volatilization process is relatively rapid, potential transport distances may still be significant in most streams.

Lithium is an alkali metal which occurs naturally in the environment Soil particles exhibit a lesser affinity for lithium than for other common alkali or alkaline earth elements. Once released in surface or ground water, lithium tends to remain in solution and be transported in the dissolved phase

Beryllium is an alkaline earth element which occurs naturally in the environment. Beryllium oxide and hydroxide compounds have very low solubilities and dissolved ions are strongly adsorbed by mineral surfaces. In natural environments, beryllium will be transported as particulate matter in wind or surface water runoff rather than in the dissolved phase.

Chromium (Cr) has two stable valence states in natural systems· Cr(III) and Cr(VI) Behavior of this transition element is strongly influenced by valence state, which in turn is a function of oxidation reduction and pH conditions. Under strongly oxidizing, moderate to low pH conditions, Cr(VI) will predominate. Cr(VI) is highly soluble, and displays only a weak affinity for solid surfaces As a result, Cr(VI) is preferentially transported in surface and ground water Under moderately oxidizing to reducing conditions, relatively insoluble Cr(III) will predominate Cr(III) displays a strong attraction for soil and sediment, and is transported as suspended particulates in surface water and air. Under conditions common in most soils, Cr(VI) is readily transformed to Cr(III).

Sulfuric and nitric acids will tend to be neutralized by carbonate and aluminosilicate minerals present in soil and sediment. The resulting neutralized solutions will contain dissolved sulfate and nitrate, respectively, as anionic species. Sulfate and nitrate are both highly soluble, and are readily leached from soils and transported in surface and ground water.

No information was found during preparation of this work plan to describe the behavior of unsaturated polyester resins such as those used in fiberglassing operations. However, their high molecular weight and resistance to water suggests that these compounds would be relatively strongly adsorbed and bound to soil and sediment.

2.5.2 Release Mechanisms and Transport Media

The historical release mechanisms identified in the OU12 site conceptual model include spills and releases from stored drums, tanks, work areas, stored machinery, and ponds These releases potentially impacted soils and sediment in the vicinity of each IHSS, with the contaminants described in the preceding section. These impacted media are considered the current contaminant source, since the original sources of spills or releases at most IHSSs are no longer present The primary release mechanisms from the current source materials to the transport media, and the potential secondary release mechanisms from the transport media are discussed in the following sections

2.5 2.1 Primary Release Mechanisms

Based on the contaminant source characteristics and the fate and transport process discussed above, primary release mechanisms for OU12 have been identified. These include: wind erosion of contaminated soil into the air as fugitive dust; vapor emissions of volatile organic compounds from soils and sediment, suspension and transport of contaminated soil and sediment via surface water runoff, tracking of contaminated soil, leaching of contaminants by infiltrating precipitation, and transport downward into ground water and bioaccumulation of contaminants in flora and fauna However, over much of the OU12 area, surface soil contamination has been isolated by concrete or asphalt pavement In these paved areas, the primary release mechanisms are severely constrained or inactive.

2.5 2 2 Secondary Release Mechanisms

After the contaminants become entrained in the transport media, the potential exists for interaction between the individual transport media. In the OU12 conceptual model, these secondary release mechanisms include percolation of vadose water and recharge of ground water; discharge and seepage of ground water; recharge of ground water by surface water; pumpage of ground water, volatilization from surface water, and deposition of dust from the air

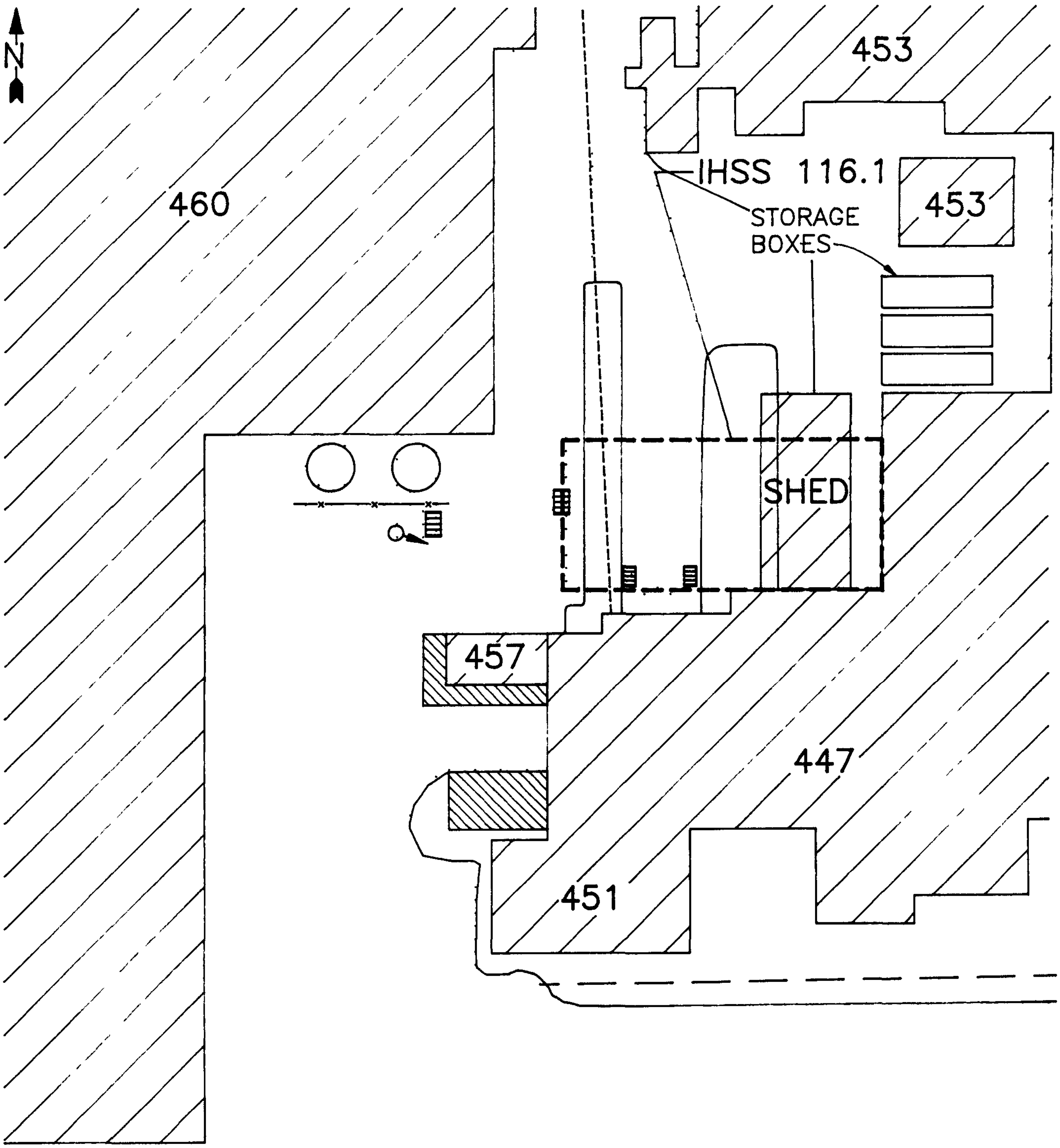
2.5.3 Exposure Routes and Receptors

As illustrated in Figures 2-39 and 2-40, contaminants released from OU12 can affect potential receptors through inhalation of airborne particles or vapors, and through ingestion of or dermal contact with contaminated source or transport media.

2.5.4 Exposure Pathway Summary

The primary goal of the OU12 RFI/RI is to gather data to define the nature and extent of contamination which supports a Baseline Risk Assessment The Baseline Risk Assessment evaluates the potential risks of OU12 contamination to human health and the environment The OU12 site conceptual model developed in the preceding sections identifies potential completed exposure pathways resulting from OU12 releases. Data necessary to evaluate each of these pathways will be collected during the OU12 RFI/RI as listed below:

- Soils/Sediment → Ingestion, Inhalation, or Direct Contact;
- Wind-Blown Dust/Volatile Emissions → Inhalation,
- Surface Runoff/Surface Water/Sediments;
- Infiltration/Percolation/Ground Water → Ingestion or Direct Contact; and
- Bioaccumulation/Bioconcentration → Ingestion or Direct Contact.



EXPLANATION

	BUILDING		PAVEMENT
	PHOTO VANTAGE POINT		CONCRETE
	IHSS BOUNDARY		SOIL OR GRAVEL
	OVERHEAD PIPING		
	STORM DRAIN		
	DRAINAGE		
	FENCE		

25 0 25 50 FEET

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GOLDEN, COLORADO

FIGURE 2-3
LOCATION OF IHSS 116.1
WEST LOADING DOCK
BUILDING 447

REVISION NO 0
FILE NAME 40103\F01-203 DWG
DATE 12/2/92
DRAWN BY EMH
APPROVED BY
CHECKED BY

Characterize the Nature and Extent of Contamination

The intent of the field sampling program to be performed during the RFI/RI is to determine the physical characteristics of all media and determine the nature and the horizontal and vertical extent of existing contamination at all OU12 IHSSs. Achieving these objectives will require the following:

- Further delineate the areal extent and location of the IHSSs,
- Define the nature and horizontal extent of surficial soil contamination,
- Define the nature and extent of contamination in the soil column beneath each IHSS,
- Determine if ground water beneath each IHSS has been affected by contamination in the overlying soils,
- Assess the potential for contaminated soil to impact the ground water;
- Determine the presence or absence of ground water contamination,
- Assess the ground water migration potential beyond the IHSS and OU12 boundaries, and
- Determine if sediment and surface water have been affected by IHSS activities

Sampling activities described in Section 6 3 of this work plan will address the objectives listed above, with the exception of surface water Surface water analysis data will be obtained from EG&Gs sitewide surface water monitoring programs. These data will be evaluated to characterize the nature and extent of contamination associated with IHSS activities

An analytical level for all of the objectives is required that yields data of sufficient quality for the baseline risk assessment, subsequent analysis, and determination of remedial alternatives Objectives will be met by adherence to the General Radiochemistry and Routine Analytical Services Protocol (GRRASP) (EG&G, 1991d) for sample analysis and RFP Environmental Management Department operating procedures (EMD SOP) (EG&G, 1991f) for sample collection

Other data needs required to characterize OU12 include:

- Determination of the location of subsurface utilities;
- Further definition of subsurface structures including footing drains, sumps, and vaults;
- Characterization of hydrogeologic conditions;
- Characterization of soils from the surface to the water table,
- Characterization of surface water and sediments; and
- Characterization of the ground water.

The objectives, type of data required, sampling/analysis activities, analytical levels, and data uses are presented in Table 4.3

Determine Risks Associated with Contamination

To meet the objectives of the baseline risk assessment, specific data need to be obtained to accomplish the four tasks of the risk assessment (data collection/evaluation, exposure assessment, toxicity assessment, and risk characterization).

These tasks will rely on data collected under a sampling plan that is sufficient to determine the contaminants present and the concentrations at which they occur Analytical data for different environmental media must be sufficient to characterize the lateral and vertical extent of contamination and be representative of sampled areas. Background or control data must also be collected at uncontaminated areas and its use agreed to by the agencies to establish baseline conditions and determine the degree to which contamination may affect receptors

This specifically requires an inventory of contaminants detected, associated concentrations, and the lateral and vertical distribution of contaminants In addition, data pertaining to physical characteristics of topography, soil, subsurface water bearing zones, and weather patterns need to be collected both to determine potential migration pathways and to conduct computer modeling studies. Characteristics and locations of possible human populations and biological populations must also be determined.

Recent toxicity information on all identified contaminants must also be collected to evaluate and determine potential risks to the identified receptors.

Support Selection of Remedial Action Alternatives

Data requirements for the evaluation of remedial action alternatives include an identification of the nature and extent of contamination at sites of concern. In addition, the volumes and areas of contaminated media must be determined. This work plan addresses the sampling required to characterize contaminated media at OU12, to support the selection of remedial alternatives in the CMS/FS, and to develop the CAD/ROD. These remedial alternatives may include removal and treatment, *in situ* treatment, containment, and no action

TABLE 4.3
PHASE I RFI/RI DATA QUALITY OBJECTIVES FOR OU12

Specific Objective (Data Need)	Data Type	Sampling/Analysis Activity	Analytical Level	Data Use
CHARACTERIZENATURE AND EXTENT OF CONTAMINATION				
Define the nature and horizontal extent of surficial soil contamination				
Characterize surficial soils	Radiation survey data	• Perform field radiation survey at IHSSs	I, II, or III	• Characterize Nature and Extent • Baseline Risk Assessment • Evaluation of Remedial Alternatives
	Surficial soil contamination data	• Collect surficial soil samples at IHSSs, analyze for parameters appropriate for each IHSS	IV (V for radiological analyses)	
Define the nature and vertical extent of contamination in the soil column beneath each IHSS				
Characterize presence or absence of soil contamination at each IHSS	Soil chemical data	• Conduct soil gas surveys at appropriate IHSSs, analyze vapor samples for volatile organic compounds	II or III	• Characterize Nature and Extent • Baseline Risk Assessment • Evaluation of Remedial Alternatives
		• Collect subsurface soil and ground water samples at IHSSs for real time analysis	II	
		• Drill borings and collect subsurface soil core samples, analyze for nonradionuclides and radionuclides at appropriate IHSSs	IV (V for radiological analysis)	

TABLE 4.3
PHASE I RFI/RI DATA QUALITY OBJECTIVES FOR OU12

Specific Objective (Data Need)	Data Type	Sampling/Analysis Activity	Analytical Level	Data Use
Characterize subsurface stratigraphy and depth to ground water	Geologic parameters	• Drill borings and log subsurface geology	I	• Characterize Nature and Extent • Baseline Risk Assessment • Evaluation of Remedial Alternatives
Determine the extent of sediment contamination	Sediment chemical data	• Collect sediment samples at select IHSSs	IV (V for radiological analysis)	• Characterize Nature and Extent • Baseline Risk Assessment • Evaluation of Remedial Alternatives
Determine if ground water beneath IHSSs has been affected by contamination in the overlying soils				
Characterize movement of water in the unsaturated zone	Soil moisture data Leachability values	• Install tensiometers at selected IHSS • Collect ground water screening samples at select IHSSs for real time analysis	I II	• Characterize Nature and Extent • Baseline Risk Assessment • Evaluation of Remedial Alternatives

TABLE 4.3
PHASE I RFI/RI DATA QUALITY OBJECTIVES FOR OU12

Specific Objective (Data Need)	Data Type	Sampling/Analysis Activity	Analytical Level	Data Use
Determine the extent of ground water contamination				
Characterize potential of ground water contamination at appropriate IHSS	Ground water chemical data	• Collect ground water samples from monitoring wells at selected IHSS	IV (V for radiological analysis)	• Characterize Nature and Extent • Baseline Risk Assessment • Evaluation of Remedial Alternatives
Assess the ground water migration potential beyond the IHSS and OU12 boundaries				
Characterize local ground water flow regime at appropriate IHSSs	Water level data	• Obtain water level measurements from well points installed at IHSSs • Install monitoring wells at IHSSs where wells are required • Conduct slug tests on wells installed at IHSSs	I I	• Characterize Nature and Extent • Baseline Risk Assessment • Evaluation of Remedial Alternative

TABLE 4.3
PHASE I RFI/RI DATA QUALITY OBJECTIVES FOR OU12

Specific Objective (Data Need)	Data Type	Sampling/Analysis Activity	Analytical Level	Data Use
DETERMINE RISKS ASSOCIATED WITH CONTAMINATION				
Contamination identification	Analytical data	• See description for Nature and Extent of Contamination	I, III, IV (V for radiological analysis)	• Baseline Risk Assessment
Exposure assessment	All data that characterize nature and extent	• See description for Nature and Extent of Contamination	I, III, IV (V for radiological analysis)	• Determine potential pathways and receptors
Toxicity assessment	Analytical data Toxicity values	• See description for Nature and Extent of Contamination	I, III, IV (V for radiological analysis)	• Determine risk to receptors
Risk characterization	Toxicity values Exposure assessment	• Not applicable	Not applicable	• Baseline Risk Assessment • Evaluation of Remedial Alternatives
Uncertainty analysis	Statistical parameters	• Not applicable	Not applicable	• Determine adequateness of data to perform Baseline Risk Assessment

TABLE 4.3
PHASE I RFI/RI DATA QUALITY OBJECTIVES FOR OU12

Specific Objective (Data Need)	Data Type	Sampling/Analysis Activity	Analytical Level	Data Use
SUPPORT SELECTION OF REMEDIAL ACTION ALTERNATIVES				
Nature and extent of contamination	Analytical data Volume of contaminated material	• See descriptions above for Characterizing Nature and Extent of Contamination		• Evaluation of Remedial Alternatives
Treatability studies	Bench-scale testing	• Collect samples pre- and post-treatment to determine effectiveness of alternative	IV (V for radiological analytes)	
Characterize site-specific geologic parameters	Soil physical parameters	• Collect soil samples for parameters identified as appropriate for each IHSS	I, II	• Evaluation of Remedial Alternatives

5.3 TASK 3 - FIELD INVESTIGATION

The OU12 RFI/RI field investigation is designed to meet the objectives outlined in Section 4 0 The following activities will be performed as part of the field investigation, as described in detail in Section 6 0

The specific objectives of the RFI/RI field investigation for OU12 are:

- Characterize the nature and extent of contamination at each IHSS;
- Support baseline risk assessment including human health and the environment, and
- Support corrective measures studies, feasibility studies, and treatability studies

The field investigation is designed to characterize current sources and potentially affected media at each IHSS Many of these sites are still active and may be active after the field sampling program is concluded Additional contamination that may occur after field sampling activities are completed cannot be determined by this program.

The field investigation developed for each IHSS will consist of two major subtasks:

- Subtask 1 - Radiation Surveys, Surficial Soil Sampling, and Chemical Screening; and
- Subtask 2 - Sediment Sampling, Vadose Zone Monitoring, Soil Boring, and Monitor Well Installation

Additional field investigation components are included in the plan to characterize potential migration throughout the OU12 area. A summary of each subtask is presented in the following sections These subtasks are discussed in greater detail in Section 6.0

5.3.1 Subtask 1 - Screening and Surficial Soil Sampling

The initial task will consist of surface and subsurface media screening and surficial soil sampling to first determine if contamination exists, and then to provide preliminary definition of the extent of contamination In addition, the locations of footing drains and building sumps will be determined Screening techniques that provide real-time results will be used to indicate general areas of radiological or chemical contamination Radiation survey techniques will include high purity germanium (HPGe) radiation surveys supplemented with Sodium Iodide Scintillation Detector (NaI probe) surveys, vertical depth profile sampling, asphalt sampling, and surficial soil sampling Surficial soil samples will also be collected and analyzed for nonradionuclides, and for verification of HPGe results. Screening methods employed to indicate potential areas of chemical concern will include collection of soil gas, soil and/or ground water screening samples for real time analysis of volatile organic compounds or other parameters using a mobile laboratory and field instruments Other screening methods will be employed at specific IHSSs to determine the presence of nitrate, hexavalent chromium, and sulfate in ground water In addition, temporary well points will also be installed to characterize the local ground water system. The proposed screening techniques will provide real time results, identify general areas of primary concern, and allow subsequent field sampling tasks to be efficiently focused

5.3.2 Subtask 2 - Sediment Sampling, Vadose Zone Monitoring, Soil Boring, and Monitor Well Installation

This task will consist of sediment sampling, vadose zone monitoring, and a focused soil boring and ground water monitoring well installation program at appropriate IHSSs to investigate and quantify the extent of contamination at potentially anomalous areas identified from screening results The locations of the sediment samples will be determined from the results of Subtask 1 The locations of the borings will be based on the real time results of the volatile organic compound screening for soil gas, soil and ground water, inorganic parameter screening, the HPGe survey for radionuclides in soil and asphalt, and the surficial soil sample analysis results for metals The borings will be drilled to bedrock and soil samples collected and analyzed for suspect compounds including volatile organic compounds and metals. Soil sample analysis results will provide quantitative data in anomalous areas tentatively identified in the screening program and be used to define the extent of soil contamination.

Ground water monitoring wells will also be installed based on results of the soil borings and the field screening subtask If screening and soil boring results indicate that ground water is potentially affected by IHSS releases, alluvial monitor wells will be installed near the centers of the affected areas to evaluate the presence of potentially contaminated ground water Ground water samples will be collected and analyzed to provide quantitative data in anomalous areas tentatively identified in the screening program and to define the extent of potential contamination associated with OU12 IHSSs.

Vadose zone monitoring will be conducted at appropriate IHSS depending on screening tasks. Tensiometer nests will be installed to monitor vadose zone water.

General procedures and analytical parameters for sediment sampling, and soil boring and monitor well installation are described in Section 6.0 of this work plan. Refinement of these procedures may be required once screening data have been collected. Any minor revisions or proposed changes to the work plan will be presented in the RFI/RI report. Any major revisions will be the subject of technical memoranda as stipulated in the IAG

IAG FIDLER instruments provide relative comparisons of radioactivity at discrete survey points whereas HPGe detectors provide individual radionuclide concentrations over the entire area surveyed

EG&G currently has in-house capability to conduct HPGe field surveys using a tripod-mounted detector The tripod-mounted detector has an approximate field of view of 14 meters, or approximately 45 feet (ft). Technical information on the HPGe detector is provided in Appendix G An SOP is currently in development. Vehicle-mounted HPGe instrumentation with a 60 meter, or approximately 195 ft, field of view is anticipated to be available for field use in late fall 1992 As described in Appendix G, the vehicle-mounted HPGe is six to eight times more sensitive than the tripod-mounted unit because it is equipped with more crystals and therefore, is the preferred detector for site use. Identical results of the same quality but at differing sensitivities are obtained from the tripod-mounted and the vehicle-mounted systems This allows for direct correlation of the results from the two systems The large grid spacing proposed for some OU12 IHSSs will be reduced if interferences from buildings require a more focused field of view, or replaced with a tripod-mounted detector, in the event that the vehicle-mounted HPGe either is not available or not effective for the field investigation The SOP for vehicle-mounted HPGe field screening is currently under development As a contingency, G-M shielded and FIDLER instruments and pancake type alpha detectors will be used at each OU12 IHSS where HPGe is currently proposed if the SOPs are not yet approved prior to OU12 field work, or if site conditions introduce other difficulties

6.2.2 Surficial Soil, Asphalt, and Vertical Depth Profile Sampling

Surficial soil sampling will be conducted both for radionuclide and nonradionuclide analysis on established grids at each IHSS. Surficial grab samples, as described in GT 08, will be collected at paved grid locations, and composite samples collected with the jig and scoop described in SOP GT 08 at exposed soil locations Sampling equipment and procedures for collecting surficial soil samples for radionuclide and nonradionuclide analysis are in Section 6.4 2 Vertical depth profile soil samples will be collected at 0 to 2, 2 to 4, and 4 to 6-inch vertical depth locations using the sampling equipment and procedures described in Section 6 4 3 Concrete or asphalt samples will be collected at survey points with anomalous surface activity Equipment and procedures for collecting concrete and asphalt samples are described in Section 6.4 4

Surficial soil samples will be collected using one methodology for both radionuclide and nonradionuclide analysis but different methodologies depending on whether the location is paved or has exposed soil For paved locations, grab samples will be collected using the grab sampling methodology in SOP GT 08 The samples will be collected from the soil substrate underlying base materials immediately beneath the pavement. At exposed soil locations, samples will be collected with the jig and scoop described in SOP GT.08. One composite sample will be collected, with subsamples located in the center and four corners of a one meter square area

Vertical depth profile samples will be collected at a subset of the exposed soil HPGe survey locations to determine the vertical extent of radionuclide contamination. Vertical depth profile samples will be collected at 0 to 2, 2 to 4, and 4 to 6-inch vertical depths at locations determined after the survey results are evaluated. This information is only required in exposed soil or gravel sites to determine the vertical distribution of gamma-emitting radionuclides contributing to the HPGe survey readings. Vertical depth profile samples are not proposed under concrete or asphalt because these dense surfacing materials attenuate gamma rays and no correlation can be made between surface HPGe measurements and

Based on results of the soil gas survey, soil and ground water screening samples will be collected and analyzed for volatile organic compounds in the mobile laboratory A minimum of four soil and two ground water screening samples will be collected and analyzed at IHSS 116 1 Additional screening points may be added to further define contamination

6 3 1 2 Soil Borings and Monitor Wells

A minimum of two ground water screening locations will be drilled using hollow stem auger techniques. The borings will be advanced to the water table or 6 ft beneath the alluvial bedrock contact whichever is encountered first. The anticipated depth of boreholes at this site is 20 ft Using the sampling methodology described in Section 6.4 of this report, a minimum of four discrete soil samples from each boring will be collected and analyzed for RFP target compound list (TCL) volatile organic compounds and a minimum of four composite soil samples will be analyzed for target analyte list (TAL) metals, PCBs, and radionuclides

One of the planned borings will be advanced to a depth of 3 ft below bedrock and completed as a monitoring well. A tentative location for the monitoring well is shown on Figure 6-2 The final location of the monitoring well will be determined after evaluation of field screening data The remaining boring will be abandoned as described in Section 6 4.6 Depth to ground water is expected to be approximately 15 ft below grade, and total depth of the boring will be approximately 28 ft. The top of the screen will be placed approximately 8 ft above the water level and will extend through saturated alluvium. The total depth of the well is anticipated to be approximately 28 ft. The well will be developed and sampled and analyzed for TCL volatiles, TAL metals, PCBs, anions, and radionuclides.

samples will be held for 30 days, and surveyed with a laboratory HPGe detector to estimate individual radionuclide concentration Two randomly selected duplicate surficial samples will be sent to an offsite laboratory for radionuclide analysis to confirm HPGe results

Sediment samples will be collected at a minimum of three locations in the ditch south of the loading dock. Samples will be analyzed for volatiles (if saturated), radionuclides, metals, and PCBs

A minimum of four soil gas samples will be collected. Soil gas samples will be analyzed for volatile organics in the mobile laboratory A minimum of four soil screening and two ground water screening samples will be collected at the soil gas survey locations and analyzed for volatile organics in the mobile laboratory.

6 3 2 2 Soil Borings and Monitor Wells

A minimum of two soil borings will be auger-drilled to the water table or 6 ft into the alluvial bedrock contact (whichever is encountered first) at anomalous areas to further define the extent of potential contamination Using the sampling methodology described in Section 6 4 of this report, a minimum of four discrete samples from each boring will be analyzed for TCL volatiles, and a minimum of four composite samples will be analyzed for TAL metals and radionuclides

Well 19689, located approximately 100 ft downgradient of the South Loading Dock, may provide contaminant and water level information for this IHSS. However, a minimum of one well will be installed at IHSS 116 2 at one of the borehole locations. A tentative location for the monitoring well is shown in Figure 6-3 The final location will be determined in the field and based on the results of the field screening The borehole will be advanced to 3 ft below the bedrock contact, or a total boring depth of approximately 25 ft. Depth to ground water is estimated to be approximately 12 ft at IHSS 116 2. Screen placement will be approximately 8 ft above the water table and extend through the full alluvial thickness Total depth of the well is anticipated to be 22 ft This well will be developed following completion, and the ground water will be sampled and analyzed for TCL volatiles, TAL metals, anions, and radionuclides Installation of additional ground water monitoring wells will be dependent on results of radiation surveys, field screening, surficial soil, sediment, soil boring, and monitor well results.

6.3.3 Cooling Tower Pond West of Building 444 (IHSS 136.1)

The West Cooling Tower Pond (IHSS 136 3 in the IAG) was renumbered as IHSS 136 1 in the HRR (EG&G, 1992c) The West Pond was historically used to impound cooling tower blowdown which may have contained hexavalent chromium in the form of chromate The HRR also indicated that lithium and small amounts of depleted uranium may have been buried at the ponds. This pond is clearly observed in aerial photographs from 1969 in Figure 2-8

The field sampling program for IHSS 136 1, West Cooling Tower Pond, is depicted on Figure 6-4 The boundaries of the IHSS, as shown on Figure 6-4, extend beneath Building 460 into areas that will be inaccessible for this investigation The cooling tower pond was backfilled and is currently paved over The sampling plan for the pond is not as detailed on the surface as it is for subsurface investigations.

6 3 3 1 Radiation Survey, Surficial Soils, and Chemical Screening

Radiation surveys using a vehicle-mounted HPGe detector will be performed on a 150-ft grid throughout the pond area, under IHSS 157.2, Radioactive Site South. Asphalt samples and NaI probe surveys will be conducted within the IHSS 157 2 radiation survey as indicated on Figure 6-1

A minimum of four surficial soil grab samples will be collected from beneath the pavement on a 25-ft grid spacing. As described for other paved IHSSs, surficial soil samples will be held for 30 days, surveyed with a laboratory HPGe detector, and submitted for laboratory analysis of TAL metals Two duplicate surficial samples will be sent to an offsite laboratory for radionuclide analysis to verify the HPGe results.

One sediment sample will be collected from a storm drain in the southwest portion of the IHSS, if enough sample volume is present in the drain. The sediment sample will be analyzed for volatiles (if saturated), radionuclides, metals, and PCBs.

A minimum of four soil and two ground water screening samples will be collected Soil cores will be collected at 2-ft intervals to identify possible staining, fill, or native soil horizons possibly associated with the ponds Ground water samples will be screened using colorimetric screening methods capable of detecting hexavalent chromium concentrations as low as 0 1 milligrams per liter.

6 3 3.2 Soil Borings

A minimum of two soil borings will be drilled to the water table or 6 ft into the bedrock contact (whichever is encountered first) at the IHSS 136 1 location to characterize lithology and to collect samples for laboratory analysis. The estimated total depth of these soil borings is 20 ft The boring program will be established using the results of field screening methods for hexavalent chromium. The borings will be drilled and sampled using the sampling methodology described in Section 6 4 of this report A minimum of four composite samples from each boring will be analyzed for TAL metals and radionuclides Soil samples from this site will be analyzed both for hexavalent and total chromium

Installation of ground water monitoring wells will be dependent on the results of radiation survey, field screening, surficial soil, sediment, and boring programs.

6.3.4 Cooling Tower Pond East of Building 444 (IHSS 136.2)

The East Cooling Tower Pond is located in the vicinity of the ditch immediately east of the 400 area security fence as shown in Figure 2-10 An outside contractor, Dowell, used it for only a few days in May 1956 In October, 1956, the empty pond was backfilled although standing water was frequently observed in the general location at this IHSS in post-1956 historical photos.

The use of the East Cooling Tower Pond is similar to the use described for the West Cooling Tower Pond. The liquids in the pond were likely to contain hexavalent chromium in the form of chromate Either the east or west pond may have contained cleaning solutions from one of the cooling towers, although cleaning solutions in cooling towers typically consist of acids and inorganic compounds. The HRR indicates an oily sheen was historically observed on the pond surface by an interviewed employee.

The field sampling program for IHSS 136.2, East Cooling Tower Pond, is depicted on Figures 6-1 and 6-5. The area has exposed soil and a north-south trending ditch extends through the IHSS. The location of the historical pond is not visible in the field other than the path of the ditch This drainage ditch could also have been what was identified as a pond in aerial photographs.

6 3 4 1 Radiation Survey, Surficial Soils, and Chemical Screening

Radiation surveys using a vehicle-mounted HPGe detector will be performed on a 150-ft grid throughout the pond area, under IHSS 157 2, Radioactive Site South In addition, a tripod-mounted detector will be used at a minimum of six locations at IHSS 136 2 to supplement the vehicle-mounted survey The detector will be set up at locations spaced 30 ft apart in the approximate center of the IHSS. A NaI probe will be used to survey a minimum of 24 sample locations to supplement the HPGe survey Vertical depth profile samples will be collected at exposed soils at a minimum of three locations in IHSS 136 2.

A minimum of eleven surficial soil samples will be collected on a 25-ft grid spacing to characterize surficial soils The samples will be surveyed with a laboratory HPGe detector to estimate isotopic radionuclide concentration Three duplicate samples will be collected and sent to a laboratory for confirmation of HPGe results. Surficial soils will also be submitted for laboratory analysis of TAL metals

Sediment samples will be collected at a minimum of four locations in the ditch that extends through the IHSS. Samples will be analyzed for volatiles (if saturated), metals, radionuclides, and PCBs

A minimum of six soil and three ground water screening samples will be collected using the hydraulic probing rig. Two-foot cores will be collected and logged to identify staining, fill, and/or native soil horizons possibly associated with the ponds. Ground water samples will be screened using colorimetric screening methods capable of detecting hexavalent chromium concentrations as low as 0.1 milligrams per liter.

6 3 4 2 Soil Borings and Tensiometers

A minimum of two soil borings will be drilled to the water table at the East Pond location to characterize lithology and to collect samples for laboratory analysis. In these soil borings, samples will be collected to the water table or 6 ft beneath the alluvial bedrock contact, whichever is encountered first. A total depth of 20 ft has been estimated A minimum of four discrete soil samples will be analyzed for TCL volatile organics, and a minimum of four composite samples will be analyzed for TAL metals and radionuclides per borehole. Soil samples from this site will be analyzed both for hexavalent and total chromium.

A tensiometer or equivalent vadose zone monitoring device will be installed in the vicinity of IHSS 136 2 to measure vadose zone moisture if indications of contamination are determined through other surveys The tentative location of the nested tensiometer is shown in Figure 6-5.

Installation of ground water monitoring wells will be dependent on results of the radiation survey, field screening, surficial soil, sediment, vadose zone and boring programs.

6.3.5 Radioactive Site South (IHSS 157.2)

The area encompassed by IHSS 157 2, Radioactive Site South includes most of the area around Buildings 444, 447 and 439. In general, the area is documented to contain low levels of uranium and chemical contamination most likely resulting from historical use of buildings in the area as a uranium foundry, a carbon machining shop and a beryllium fabrication facility Other compounds used in the area include hydraulic oil and carbon tetrachloride in Buildings 439 and 440 Four of the IHSSs within OU12 are fully encompassed by IHSS 157.2, and are addressed individually These IHSSs include the West and South Loading Docks (IHSSs 116 1 and 116.2, respectively), the Cooling Tower Pond West of

Building 447 (IHSS 136 1), and the Cooling Tower Pond East of Building 444 (IHSS 136 2) Other areas of potential interest in IHSS 157 2, including the Ingot Open Storage Area, were considered in development of the field sampling program. The IHSS 157 2 FSP described in this section was designed to investigate the general condition of IHSS 157 2, and to specifically investigate areas of suspect historical activity not already identified as an IHSS

The field sampling program for IHSS 157 2, Radioactive Site South, is depicted on Figures 6-1 and 6-6 As shown in the figures, the boundaries of the IHSS totally encompass Buildings 444, 439 and 447, and include portions of Building 460. Areas beneath these buildings are inaccessible for field investigation. All of IHSS 157.2 is within a security area, and field work within the area may be limited in some instances for security reasons Most of the area is paved with asphalt or concrete, and there are utility lines and sewer lines in some locations There are original process waste lines under Building 444 that extend past the IHSS 157 2 boundary to the north.

6 3 5 1 Radiation Survey, Surficial Soils, and Chemical Screening

Radiation surveys using a vehicle-mounted HPGe detector will be performed on a 150-ft grid throughout IHSS 157 2 to document surficial conditions throughout the area as shown on Figure 6-1 The IAG required a G-M survey at 480 locations, however, the HPGe detector provides better results over a larger area Therefore, only 22 locations are required to provide coverage of the entire IHSS Three tripod-mounted HPGe survey locations have been added in areas where past activities may have resulted in contamination and where building structures may hinder the ability to obtain accurate results. Some of these locations are in IHSSs totally encompassed by IHSS 157 2. In addition, the six tripod-mounted HPGe survey locations proposed for IHSS 136 2 will provide data for IHSS 157.2. NaI probes will be used to survey anomalous readings from the HPGe A minimum of twelve asphalt core samples will be collected at HPGe survey locations with anomalous radioactivity for confirmation of HPGe results A minimum of twelve soil depth profile samples will be collected at HPGe survey locations.

A minimum of 46 surficial soil samples will be collected from alternate nodes on a 50-ft grid from exposed soil areas and from under the concrete and asphalt pavement, as shown in Figure 6-6. Surficial soil samples will be surveyed with a laboratory HPGe detector to directly measure radionuclide concentration Surficial soil samples will also be submitted to a laboratory for analysis of TAL metals Eight duplicate surficial soil samples will be sent to a laboratory for full radionuclide analysis and confirmation of HPGe results.

A minimum of five sediment samples will be collected from drainage ditches in the southern and eastern portions of the IHSS Samples will be analyzed for volatiles (if saturated), radionuclides, metals, and PCBs

Soil gas screening within IHSS 157 2 will be conducted on an approximate 50-ft grid. A minimum of 81 soil gas survey points are proposed, as shown in Figure 6-6. Soil gas samples will be analyzed for volatile organics in the mobile laboratory. Based on results of the soil gas survey, a minimum of 40 soil and 20 ground water screening samples will be collected at soil gas survey locations using the hydraulic probing rig and analyzed for volatile organics in the mobile laboratory Temporary well points will be installed and surveyed at 10 of the ground water screening locations to obtain water level information and determine local hydraulic gradient Placement of well points will consider not only screening results from IHSS 157 2, but also those of IHSSs 116 1, 116.2, 136.1, and 136.2

6 3 5 2 Soil Borings

A minimum of eight soil borings will be drilled within the IHSS, based on field screening and radiological survey results Borings will be drilled to the water table or 6 ft below the alluvial bedrock contact, whichever is encountered first Samples will be collected according to methodology described in Section 6 4 The estimated total depth of borings in this area is 20 ft below the surface. Using the sampling methodology described in Section 6.4 of this report, a minimum of four discrete samples will be analyzed for TCL volatile organics from this IHSS and a minimum of four composite samples will be analyzed for TAL metals and radionuclides

Installation of ground water monitoring wells will be dependent on results of the radiation survey, field screening, surficial soil, sediment, and soil boring programs.

6.3.6 Sulfuric Acid Spill (IHSS 187)

IHSS 187, Sulfuric Acid Spill, is located immediately east of Building 443. A 3,000-gallon tank storing sulfuric acid leaked approximately half of its contents in September, 1970, and followed an eastward path where it was captured in two earthen pits and neutralized. The spill location and path of the spill were presented in Section 2 0 During spill neutralization activities, approximately 32,000 pounds of lime were used Since the spill occurred, the tank has been taken out of service, and much of the spill area has been graded over and buildings, trailers, tanks and sidewalks now cover the spill site

Limited field sampling at the source area is proposed for this IHSS as depicted in Figure 6-7 Because sulfuric acid is not typically persistent in the environment and it was effectively neutralized, it is not anticipated that the historical spill is currently impacting soil or surface water at IHSS 187 Sulfate could have infiltrated through soils to ground water, therefore, surficial soil sampling and ground water field screening will be conducted. Surficial soils will be collected at a minimum of five locations and analyzed in the field to determine pH At three of the locations, the hydraulic rig will be used to obtain a ground water sample for field screening of sulfate and pH Turbidimetric methods are applicable for obtaining screening information for sulfate content in ground water and will be performed as outlined in SOP GW 5 Field instruments will be used to determine ground water pH Additional sampling along the spill pathway will be conducted if the samples from the source area are determined to be contaminated.

6.3.7 Fiberglassing Area North of Building 664 (IHSS 120.1)

IHSS 120 1, Fiberglassing Area North, was used historically for fiberglassing waste packing boxes in the 1970's. The area may contain residue from spills of polyester resin, peroxide catalyst materials, and cleaning solvents as mentioned in the HRR Information in the HRR also indicates that elevated gamma radiation and americium were historically detected in the vicinity of the IHSS, although the source of radioactivity was not identified. A fiberglass-sided shed on a concrete slab is located within this IHSS The area is fenced, although access is not restricted. Empty 55-gallon drums are stored throughout the yard. It is assumed stored drums will be removed prior to implementation of the field sampling plan at IHSS 120 1

The field sampling program for IHSS 120 1, Fiberglassing Area North, is depicted on Figure 6-8 The sampling program designed for the fiberglassing site is designed to locate potential spill areas as well as generally characterize the IHSS.

6 3 7 1 Radiation Survey, Surficial Soils, and Chemical Screening

Radiation surveys using a vehicle-mounted HPGe detector will be performed on a 150-ft grid throughout the Building 664 area as shown on Figure 6-1 In addition, a tripod-mounted HPGe detector will be used at locations spaced 30 ft apart to supplement the vehicle-mounted HPGe results due to possible interference from Building 664 A NaI probe will be used to survey anomalous readings from the HPGe. Vertical depth profiles will be collected at a minimum of three of the HPGe survey locations

A minimum of nine surficial soil sampling points will be established on a 25-ft grid at IHSS 120.1 Samples will be surveyed with the laboratory HPGe and analyzed for TAL metals

Soil gas will be used to determine the lateral extent of potential contamination from spills of solvents associated with historical fiberglassing activities Soil gas data collection points will be located on an approximate 25-ft grid as indicated on Figure 6-8. A minimum of nine soil gas points are proposed at IHSS 120 1 Soil gas samples will be analyzed in the mobile laboratory for volatile organics A minimum of five soil and three ground water screening samples will be collected and analyzed for volatile organics in the mobile laboratory, based on soil gas screening results Temporary well points will be installed and surveyed at the three ground water screening locations to determine local water table elevation and hydraulic gradient

6 3 7 2 Soil Borings and Tensiometers

A minimum of two deep borings will be drilled at IHSS 120 2, the locations of which are tentatively shown on Figure 6-8. These locations may be refined based on radiation survey and screening results The two borings will be drilled to the water table, or 6 ft beneath the alluvial bedrock contact (whichever is encountered first) estimated to occur less than 20 ft below the surface in this area Using the sampling methodology described in Section 6 4 of this report, a minimum of four discrete samples from IHSS 120.1 will be analyzed for TCL volatile organics, and a minimum of four composite samples will be analyzed for radionuclides and metals, per borehole.

Tensiometers or equivalent devices may be installed in the vicinity of IHSS 120 1 to measure vadose zone moisture if indications of contamination are determined through other surveys The tentative location of the nested tensiometers is shown in Figure 6-8.

Installation of ground water monitoring wells will be dependent on results of the radiation survey, field screening, surficial soil, and boring program.

6.3.8 Fiberglassing Area West of Building 664 (IHSS 120.2)

The fiberglassing area west of Building 664, IHSS 120 2, has a history similar to the north fiberglassing area. Building 664 is used for radioactive waste storage, however, and could interfere with radiological surveys conducted in the area Soils are exposed over a portion of this site, although asphalt paving is located near the loading dock door.

The field sampling program for IHSS 120 2, fiberglassing area west of Building 664, is depicted on Figure 6-9 The sampling program designed for this IHSS is similar to that designed for IHSS 120 1, with minor variations

6 3 8.1 Radiation Survey, Surficial Soils, and Chemical Screening

Radiation surveys using a vehicle-mounted HPGe detector will be performed on a 150-ft grid throughout the Building 664 area as shown on Figure 6-1. Due to possible interference from Building 664, a tripod-mounted HPGe survey will be performed at a minimum of five locations on a 30-ft grid throughout IHSS 120 2, as shown on Figure 6-1 A NaI probe will also be used to survey anomalous readings from the HPGe. A minimum of three asphalt core samples will be collected at HPGe survey locations A minimum of one depth profile sample will be collected at the exposed soil HPGe survey locations

A minimum of eleven surficial soil samples will be collected on a 25-ft grid at the site and surveyed with the laboratory HPGe for radionuclides and sent to a laboratory for TAL metals analysis The two surficial samples in exposed soil areas and two of the surficial soil samples collected beneath pavement will be split and sent to a laboratory for full radionuclide analysis to confirm HPGe results.

Soil gas will be used to determine the horizontal extent of potential contamination from spills or historical fiberglassing activities A minimum of 11 soil gas samples on a 25-ft grid will be collected at IHSS 120.2, and analyzed for volatile organics in the mobile laboratory A minimum of six soil and three ground water screening samples will be collected and analyzed in the mobile laboratory, based on soil gas results. A minimum of three temporary well points will be installed in the ground water screening locations and surveyed at IHSS 120 2 to measure local water table elevation and hydraulic gradient

6 3 8 2 Soil Borings

A minimum of two soil borings will be drilled at IHSS 120.2, the tentative locations of which are shown in Figure 6-9 The borings will be drilled to the water table or 6 ft beneath the alluvial bedrock contact (whichever is encountered first), which occurs less than 20 ft below the surface and sampled Using the sampling methodology described in Section 6 4 of this report, a minimum of four discrete samples will be analyzed for TCL volatiles and a minimum of four composite samples will be analyzed for radionuclides and metals, per boring

Installation of ground water monitoring wells will be dependent on results of the radiation survey, field screening, and soil boring program

6.3.9 Nitric Acid Tanks (IHSS 189)

IHSS 189, Nitric Acid Tanks, consists of two 10,000-gallon nitric acid storage tanks where several small spills of nitric acid have been historically documented The tanks are within concrete containment structures, and there is no visible evidence of degradation in the area

A limited sampling program is proposed for this site consisting of surficial soil and ground water screening in the vicinity of the tanks A minimum of five sampling locations outside of the containment berm are identified in Figure 6-10. A minimum of five surficial soil samples will be analyzed in the field for pH At a minimum of three of the locations, the hydraulic probe will be used to collect ground water screening samples to determine nitrate concentration Colorimetric test kits will be used to determine if detectable nitrate is present in local ground water Ground water pH will also be measured in the field Historical information indicates nitric acid stored in the tank was transferred into the tanks from vendors and the tanks were unlikely to contain waste acids containing dissolved constituents or metals.

6.3.10 Building 881 Conversion Activity Contamination (IHSS 147.2)

Building 881 was converted in 1964 from enriched uranium manufacturing activities to become a nonradioactive metals fabrication facility. Equipment from this conversion were stored in this area and include lathe and rolling mill parts. Mobile trailers, steel boxes containing depleted uranium, and a fenced storage area cover portions of the site. The steel boxes containing depleted uranium will be removed prior to conducting any sampling at this IHSS

A limited field program will be conducted at the Building 881 Conversion Activity Site as depicted on Figure 6-11 A tripod-mounted HPGe survey will be conducted at a minimum of nine locations on a 30-ft grid supplemented with NaI probe measurements at anomalous areas Soil depth profile samples will be collected at a minimum of three HPGe locations and surveyed with laboratory HPGe A minimum of nine surficial soil samples will be collected, surveyed with the laboratory HPGe, and submitted for offsite laboratory analysis of TAL metals The need for additional sampling activities will be evaluated after the data have been reviewed

6.4 SAMPLING EQUIPMENT AND PROCEDURES

Appropriate field sampling and decontamination procedures for the OU12 RFI/RI field investigation will be in accordance with the most recent version of the RFP Environmental Management Division Operating Procedures (EMD SOPs) (EG&G, 1991f) dated March 1, 1992. Appropriate EMD SOPs are referenced in the following sections. The EMD SOPs are supplemented by EPA procedures (EPA, 1989c) and American Society of Testing Materials (ASTM) standards (ASTM, 1991) EMD SOPs are currently in development for some of the procedures within this plan

6.4.1 Radiation Survey Procedure

Radiation surveys will be conducted with a high purity germanium (HPGe) gamma ray detector developed for high resolution spectroscopy. The HPGe has a broad energy range, exhibits high resolution, excellent gain stability, moderate area averaging, and the ability to identify and quantify all gamma emitting radionuclides Radiation survey locations are IHSS specific and are discussed in Section 6 3 Vehicle-mounted HPGe detector surveys will be conducted on a 150-ft grid at OU12 IHSS 157 2, which will also provide coverage of IHSSs 116.1, 116 2, 136 1, and 136 2 One additional survey point in the 600 building area will provide coverage for IHSS 120 1 although tripod-mounted HPGe surveys will also be conducted on a 30-ft grid at IHSSs 120 1, 120 2, and 136.2, and three selected locations in IHSS 157 2 A 30-ft grid was selected for the fiberglassing area located near Building 664 to provide increased resolution for the high background sites. The HPGe detector provides radionuclide concentrations in soil in picoCuries per gram (pCi/g) of gamma-emitting radionuclides including, but not limited to, potassium-40, radium-226, thorium-232, cesium-137, americium-241, plutonium-239, -240, and -241, and uranium-233, -234, -235, and -238 While plutonium is primarily an alpha emitter, gamma and x-rays are also emitted. Plutonium emits gamma rays at very low branchings that can be detected with high sensitivity instruments, such as the HPGe detector. Tritium and strontium-90 are not detected using this method Appendix G contains detailed technical information on the vehicle-mounted and tripod-mounted detectors. The EMD SOP for the HPGe is presently under development and will be available prior to any OU12 field work. Other equipment requirements are listed in Section 5 2 of EMD SOP FO.16

A NaI probe will be used to supplement the HPGe data at IHSSs where buildings or obstructions may limit HPGe effectiveness and to provide spatial resolution of HPGe readings The NaI scintillation detector has advantages over other detectors that include. higher probability of interaction per centimeter, a high light yield from deposited energy, and a high atomic number The EMD SOP for the NaI scintillation detector is currently under development and will be available prior to any OU12 field work.

To supplement the HPGe and NaI probe surveys, surficial soils, vertical depth profile samples, and concrete or asphalt samples collected via procedures in Section 6 4 2, 6 4 3, and 6 4 4, respectively will be surveyed with a laboratory HPGe detector to obtain radionuclide concentrations A SOP for laboratory HPGe field screening is currently in development and will be submitted prior to any OU12 field work

6.4.2 Surficial Soil Sampling Procedure

Surficial soil samples for radionuclide and nonradionuclide analysis will be collected both from paved and exposed soil areas in OU12 IHSSs Separate surficial soil sampling procedures are required for

- radionuclide and nonradionuclide composite sampling at exposed soil sites, and
- radionuclide and nonradionuclide grab sampling at covered sites

The jig and scoop described in SOP GT 08 will be used to collect surficial soil composite samples for radionuclide and nonradionuclide analysis at exposed soil locations. Surficial soil samples collected from exposed soil sites will be composites of subsamples collected with the jig and scoop from the four corners and center of a one meter square area. SOP GT 8 is currently under revision to include a description of this sampling procedure. It will be submitted prior to conducting OU12 field work.

At asphalt or concrete-covered sites, surficial soil grab samples will be collected both for radionuclide and nonradionuclide analysis. Grab samples underlying pavement will be collected in accordance with "grab method" procedures in SOP GT.08. Pavement or concrete will be cut and samples collected from soil substrate underlying base materials immediately beneath pavement

Surficial soil samples for radionuclide analysis will be analyzed onsite with the laboratory HPGe detector A subset of surface samples that represent a range of radionuclide concentrations will initially be surveyed with the laboratory HPGe detector, then sent to an offsite laboratory for radionuclide analysis and HPGe verification. Nonradiological surficial soil samples will be submitted to an analytical laboratory for TAL metal analysis

6.4.3 Vertical Depth Profile Procedures

Vertical soil depth profile samples will be collected at exposed soil HPGe survey locations to correlate HPGe and NaI probe results with depth distribution. Tentative locations are shown on Figure 6-1, although the vertical profile sample locations will be determined after evaluation of the HPGe/NaI probe surveys. They will typically be collected with a plug type sampler at 0 to 2, 2 to 4, and 4 to 6 inch depth intervals. A SOP for this procedure will be developed and submitted prior to conducting OU12 field work.

6.4.4 Concrete or Asphalt Sampling

Concrete or asphalt samples will be collected at areas of anomalous activity identified by the HPGe and NaI probe surveys for radionuclide analysis with the laboratory HPGe. Tentative locations are shown on Figure 6-1 The location of concrete or asphalt samples will be determined after evaluation of the HPGe/NaI probe surveys Samples will be collected with the aid of asphalt or concrete cutters or saws Procedures for obtaining and analyzing such samples for radionuclides will be submitted in an SOP prior to conducting OU12 field work

6.4.5 Sediment Sampling

Sediment samples will be collected from tentative locations identified in Section 6.3. If sediments are saturated, a core sampler with a core liner will be used to collect the top two inches of bed materials for analysis of volatile organics Samples for nonvolatile analysis will be collected with a stainless scoop Sampling procedures will follow those outlined in EMD SOP SW 6 Sediment materials will be described according to EMD SOP GT 1

6.4.6 Chemical Screening Procedures

Real time soil gas sampling will be conducted at specific OU12 IHSSs presented in Section 6 3 according to procedures in EMD SOP GT 9 Soil gas samples will be collected through a 1-inch diameter stainless steel probe rod driven with a hydraulic rig mounted on an all terrain vehicle (ATV). If possible, depending on subsurface conditions, the rig will hammer through overlying concrete or asphalt and drive probe rods through subsurface materials Soil gas samples will be collected at an approximate depth of 5 ft through tubing placed through the center of the rod Samples collected through the tube will be immediately injected into the mobile laboratory for volatile organic compound analysis Additional information on collecting soil gas samples with the ATV-mounted rig are in Appendix H Alternative soil gas techniques, such as passive collection methods, may be utilized if site conditions warrant.

Soil screening samples are also collected using the hydraulic probing rig. A Kansas Soil Sampler is attached to the end of the rod, and an extension rod inserted to release a piston within the sampler The sampler is driven 1 ft and a soil core removed. The soil sampler will be used to collect discrete screening samples for volatile organic compound analysis in the mobile laboratory Additional information on collecting soil samples for screening is in Appendix H A SOP will be developed to support collection of soil screening samples using the hydraulic probing rig.

Ground water screening samples can be collected and analyzed using the hydraulic probing rig if favorable geologic conditions are encountered The 1-inch diameter probe rod is advanced to within 1 ft of ground water. A well point sampler is attached to the probe and lowered to the bottom of the borehole It is driven into ground water and a sample is collected through sampler perforations Teflon tubing is inserted through the rod and ground water is pumped to sample containers and analyzed for volatile organics in the mobile laboratory Hexavalent chromium and nitrate can also be analyzed using field colorimetric methods, and sulfate by turbidimetric methods, in IHSSs where this analysis is appropriate based on site history Additional information on ground water screening sample collection is provided in Appendix H A SOP will be developed to support collection of ground water screening samples using the hydraulic probing rig

Temporary well points will be advanced to ground water within IHSSs 157.2, 120.1 and 120 2 to obtain water level information and to determine the ground water flow direction. A pneumatic water level indicator lowered through the probe rod will be used to measure water levels and identify ground water flow direction This procedure will be documented in the proposed ground water screening SOP prior to implementation.

6.4.7 Borehole Drilling and Soil Sampling Procedures

Borings will be drilled to determine the geotechnical characteristics of the soil, to further investigate trends identified in screening tasks, to collect samples for physical and chemical analysis, and to install monitoring wells Before any boreholes are drilled, utilities will be located and the drill site will be cleared in accordance with EMD SOP GT.10.

Borings drilled for the purpose of documenting soil contamination will be drilled to the water table or 6 ft below the alluvial bedrock contact, whichever is encountered first.

Drilling the 6-ft bedrock internal will allow a complete sample representative of bedrock conditions to be collected and analyzed

Hollow-stem auger drilling will be conducted in accordance with EMD SOP GT 2, except where material is impenetrable with this method If augering is ineffective, rotary drilling will be used in accordance with EMD SOP GT 4. Rotary drilling will only be used in situations where material is impenetrable, with hollow-stem augering the method of choice

All drill cuttings and soil samples will be surveyed for radionuclides and organic vapors in accordance with EMD SOP FO.15, Use of Photoionizing and Flame Ionizing Detectors, and EMD SOP FO 6, Field Radiological Measurements. Investigation-derived wastes, such as drill cuttings and residual samples, will be handled according to guidelines in EMD SOP FO 8 and FO 9.

All equipment must be decontaminated before and after drilling and sampling takes place in accordance with the procedures outlined in the EMD SOP FO 3 and FO.4 Decontamination water will be handled according to guidelines in EMD SOP FO 7.

All of the borings not completed as monitoring wells will be grouted and abandoned immediately after drilling in accordance with procedures outlined in EMD SOP GT 5 Procedures specified in this EMD SOP are designed to prevent vertical migration of contaminants after abandonment

Equipment requirements are listed in EMD SOP GT.2, Section 5 1; and other applicable EMD SOP are listed in Section 4 2 of this work plan.

Soil and bedrock samples will be collected during drilling for visual logging in accordance with EMD SOP GT.1 and for chemical and physical analysis in accordance with EMD SOPs GT 2 and FO 13 The soil and bedrock samples will be collected using a hollow-stem auger with a continuous-core sampler Continuous core will be collected for geologic descriptions for the entire borehole depth From this core, discrete, 2-ft samples will be submitted for laboratory volatile organic analyses (VOA) beginning at a depth of 2 ft from the ground surface, as shown in Figures 6-12 and 6-13, continuing to the water table or to bedrock, whichever is encountered first. In addition, a discrete VOA sample will be submitted to the laboratory if staining, discoloration, odor or other anomaly is observed during drilling. VOA soil samples should be collected in core liners that are capped and sealed upon recovery. In addition to the VOA samples, linear depth composite samples from the core will be submitted to the laboratory for analysis of the remaining chemical parameters from every consecutive 6-ft interval to the water table.

Soil samples for geotechnical analysis require a minimum amount of disturbance and will be collected in thin-walled metal tubes The thin-walled metal tube will be driven into the undisturbed soils in advance of the hollow-stem auger, removed, and the tube sealed for transport to the laboratory Any changes to these geotechnical sampling procedures will be the subject of a Document Change Notice (DCN).

6.4.8 Tensiometer Installation and Monitoring Procedures

Standard nested tensiometers equipped with pressure transducers, or equivalent moisture monitoring equipment, may be installed to measure matric potential of water in the unsaturated zone The tensiometers will likely consist of a porous ceramic cup attached to a rigid plastic tube. The internal volume of the system will be completely filled with water The pores in the cup form a continuum with the pores in the soil. Water will move either into or out of the tensiometer system, until equilibrium is attained across the ceramic cup Multiple tensiometers allow for the determination of the direction, and in some cases the quantity, of water flux from the ground surface to the water table.

Nested tensiometer arrays will be installed at select OU12 IHSSs as described in Section 6 3 Each array will consist of multiple tensiometers buried at 2-ft intervals from 1 ft above the water table to within 2 ft of the ground surface The tensiometers will be installed using the hydraulic probe to minimize the soil disturbance The probe holes will be backfilled with uncontaminated naturally occurring soils to a compaction slightly greater than the bulk density of the undisturbed soils to reduce surface water infiltration, which results in abnormally low tensions in the backfill and the undisturbed soil

Water used in the tensiometers must be de-aerated and onsite purging may be necessary to prevent the formation of bubbles which can prevent accurate data collection. Purging time will be kept short to minimize wetting of soil adjacent to the porous tensiometer cup When purging is complete, the system is closed and the soil draws water through the porous cup until equilibrium is established and the pressure is recorded by the pressure transducer and data logger

The tensiometers will be monitored for as long as the project schedule allows. The EMD SOP for the installation and monitoring of tensiometers is presently under development and will be submitted for approval by EPA and CDH

6.4.9 Installing and Sampling of Ground Water Monitoring Wells

All monitoring wells will be constructed with materials specified in EMD SOP GW.6 A hollow-stem auger with an inner diameter a minimum of 4 inches larger than the well casing outer diameter will be used to drill the monitoring wells to produce a minimum annular space of 2 inches. Well construction techniques will follow procedures outlined in EMD SOP GT 6 Investigation-derived wastes such as cuttings and residual samples will be handled in accordance with guidelines outlines in EMD SOP FO 8

Well construction techniques for all monitoring wells will follow procedures contained in EMD SOP GT 6 Monitoring wells in high-traffic paved areas will be completed flush with the pavement Wells in areas not exposed to vehicular traffic will be protected by the placement of steel posts around the monitoring wells, as described in EMD SOP GT 6 Pressure grouting procedures will follow guidelines outlined in EMD SOP GT.3. Additional equipment and materials that may be needed for monitoring well installation are listed in EMD SOP GT 6, Section 5 1, other related EMD SOP are cross-referenced in Section 4.2 of EMD SOP GT 6

The wells will be developed no sooner than 48 hours and no longer than two weeks after completion and will not be sampled until at least two weeks after development Water levels will be measured in all wells and recorded as outlined in EMD SOP GW.1 and the appropriately cross-referenced EMD SOP listed in Section 4.2 of the EMD SOP GW 1 After the water levels reach static conditions, the wells will be developed utilizing low-energy methods, such as an inertial pump or bottom discharging bailer. Well development will follow procedures outlined in EMD SOP GW.2.

Purging procedures will follow those contained in EMD SOP GW.6 and include purging of three to five casing volumes of water or other appropriate criteria. Field parameters (pH, specific conductance, temperature) will be measured after every half casing volume is removed as described in EMD SOP GW 6.

Ground water samples will be collected in a manner that will minimize the amount of agitation or limit the exposure of the sample to the atmosphere Ground water sampling will be by bailing or the use of a bladder or peristaltic pump. Samples will be collected, handled, and screened in accordance with EMD SOP GW 6 and all related EMD SOP.

All development and purge water will be handled in accordance with guidelines outlined in EMD SOP FO 8 Equipment needed for ground water sampling is listed in EMD SOP GW 6.

Hydraulic testing will be conducted on all ground water wells installed in OU12 Hydraulic testing of ground water wells will include slug tests or injection tests in accordance with SOP GW 4 and GW 5, respectively

Field parameters will be measured when each ground water sample is collected Specific conductance, pH, temperature, dissolved oxygen, redox potential, total alkalinity, and turbidity will be measured when ground water samples are collected in accordance with EMD SOP GW 6 Water level measurements will be conducted in accordance with EMD SOP GW 1 and the appropriately cross-referenced EMD SOP listed in Section 4 2 of this EMD SOP GW 1

6.4.10 Surveying of Sample Locations

The locations of all radiation survey points, soil gas survey points, borings, monitor wells, and surface sampling points will be measured with a steel tape prior to sampling or drilling. After sampling, drilling, or well installation, locations will be surveyed using standard land surveying techniques described in the EMD SOP GT 17 Horizontal accuracy will be ±0 5 ft for surficial soil samples, soil gas survey points, and borings and ±0.1 ft for temporary well point locations and wells Vertical accuracy will be ±0 1 ft for borings and well point locations, and ±0 01 ft for wells Three elevations will be determined for each well ground surface, top of well casing, and top of surface casing

6.5 SAMPLE ANALYSIS

This section describes the sample handling procedures and analytical program for samples collected during the RFI/RI investigation. It also includes discussions of sample designations, analytical requirements, sample containers and preservation, and sample handling and documentation

6.5.1 Sample Designation

All sample designations generated for the RFI/RI will conform to the input requirements of the Rocky Flats Environmental Data System (RFEDS) Each sample designation will contain a nine-character sample number consisting of a two-letter prefix identifying the media sample (e g , "SB" for soil borings, "SS" for surface soils), a unique five-digit number, and a two-letter suffix identifying the contractor. One sample number will be required for each sample generated, including QC samples A similar sample designation system will be used for samples collected during the field screening task including soil gas results, soil and ground water screening results, and radiological surveys. Boring numbers will be developed independently of the sample number for a given boring and are assigned by EG&G with appropriate cross-references. These sample numbering procedures are consistent with the RFP QAPjP If input requirements for the RFEDS system have changed from the above listed, the most current system will be used

6.5.2 Analytical Requirements

The analytical suites for each OU12 IHSS were developed according to the type of waste suspected to be present at each site. Table 6 2 lists the specific analytes in the above groups and their CLP detection/quantitation limits Generally, samples from the RFI/RI will be analyzed for some or all of the following radionuclide and chemical parameters.

- Uranium-233/234, 235, 236, and 238;
- Cesium-137,
- Strontium-90,
- Tritium,
- Transuranic elements (plutonium and americium);
- Gross alpha and gross beta,
- TCL volatiles; and
- TAL metals

Additional parameters, such as pH, will be requested for analysis of soil and sediment samples based on site-specific information Other parameters may include total and hexavalent chromium analysis, and PCB analysis, if appropriate

Ground water samples collected from wells installed in the OU12 RFI/RI will be analyzed for the parameters listed above as well as major cations, major anions, total dissolved solids, and pH Other field parameters, including pH, conductivity, temperature, dissolved oxygen, oxidation-reduction potential, sulfate, nitrate, and turbidity will be measured in accordance with EMD SOP GW.5, Field Measurement of Ground Water Field Parameters. Additional parameters such as hexavalent chromium will be requested on a site-specific basis

The analytes and detection limits detailed in Table 6 2 address the bulk of detection of potential soil, sediment, and ground water contamination Nitrates are included because low-level radioactive wastes with high nitrate concentrations may be present Metals are suspected at many of the IHSSs in OU12, therefore, all of the TAL analytes have been selected for RFI/RI analysis Both filtered and unfiltered samples of ground water will be collected and analyzed at each location

The following uranium isotopes have been selected for analysis uranium-233/234, uranium-235, uranium-236, and uranium-238 Plutonium is the only transuranic element that is used on the site However, americium is a daughter product of plutonium and has been detected in soil at OU12 Therefore, both plutonium and americium have been selected as radionuclide parameters. The uranium isotopes, plutonium, and americium can all be detected with the HPGe detector Tritium, cesium-137, and strontium-90 will also be analyzed in samples submitted to radiochemistry laboratory for analysis. The HPGe detector will not provide results for tritium and strontium-90. Gross alpha and gross beta are included as general radiological parameters because they are useful indicators of radionuclides Gross alpha and gross beta will be requested on all soil, sediment, and ground water samples sent to an offsite laboratory for analysis

Volatile organics have been historically stored and spilled at many of the OU12 IHSSs. Therefore, all of the TCL volatile organics will be included. Semivolatile organics have not been reported in historical descriptions of IHSS activities, and will not be analyzed

A list of analytical parameters and proposed detection limits for the soil gas surveys at OU12 are in Table 6.4 The mobile laboratory GC is capable of detecting other volatile organics as presented in Appendix H

6.5.3 Sample Containers and Preservation

Sample volume requirements, preservation techniques, holding times, and container material requirements are dictated by the media being sampled and the analyses to be performed The matrices to be analyzed include soils and sediments, and the water matrices for analysis include ground water Table 6 3 lists the analytical parameters of interest in OU12 for water and soil matrices, along with the associated container size, preservatives (chemical and/or temperature), and holding times. Additional specific guidance on the appropriate use of containers and preservatives is provided in EMD SOP FO.13 (Containerizing, Preserving, Handling, and Shipping of Soil and Waste Samples).

6.5.4 Sample Handling and Documentation

Sample control and documentation is necessary to ensure the defensibility of data and to verify the quality and quantity of work performed in the field Accountable documents include logbooks, data collection forms, sample labels or tags, chain-of-custody forms, photographs, and analytical records and reports. Specific guidance defining the necessary sample control, identification, and chain-of-custody documentation is discussed in EMD SOP FO 13

6.6 DATA MANAGEMENT AND REPORTING

Field data will be input to the RFEDS using a DATACAP remote data entry module supplied by EG&G Data will be entered on a daily basis, and a 3.5-inch computer diskette will be delivered to EG&G on a weekly basis. EG&G updates RFEDS on a weekly basis. Data from the system will be available to the contractor immediately after the weekly update A hard copy report will be generated from the module for contractor use. The data will undergo a prescribed QC process based on EMD SOP FO 14.

The contractor will maintain a data base for field data that is collected during screening tasks The contractor will provide 3 5-inch diskettes and hard copies to EG&G for their use

A sample tracking spreadsheet will be maintained by the contractor for use in tracking sample collection and shipment EG&G will supply the spreadsheet format and will stipulate timely reporting of information These data will also be delivered to EG&G on 3 5-inch computer diskettes. Computer hardware and software requirements for contractors using government-supplied equipment will be supplied by EG&G Computer and data security measures will also follow acceptable procedures outlined by EG&G. The RFEDS system is evolving Data management will follow the procedures in effect at the time this field work is implemented

Forms provided in the various SOP referenced in Sections 6.3, 6 4, and 6 5 will also be utilized as appropriate to document and manage the data obtained during the OU12 RFI/RI Copies of appropriate RFEDS forms are presented in Appendix I

6.7 FIELD QC PROCEDURES

Field QC procedures for media screening tasks, soil sampling, and ground water sampling are discussed in this section. Field procedures for soil and ground water sampling are established from previous investigations at RFP QC procedures for media screening including equipment calibration, media sample collection procedures and equipment, and decontamination procedures are presented in Appendix H.

Sample duplicates, field preservation blanks, and equipment rinseate blanks will be prepared The analytical results obtained for these samples will be used by the RPD project manager to assess the quality of the field sampling effort. The types of field QC samples to be collected and their application are discussed below The frequency with which QC samples will be collected and analyzed is provided in Table 6 5

Duplicate samples will be collected by the sampling team for use as a relative measure of the precision of the sample collection process These samples will be collected at the same time, using the same procedures and equipment, and in the same types of containers as required for the samples They will also be preserved in the same manner and submitted for the same analyses as required for the samples

Field blanks of analyte-free (ASTM Type II) water will be prepared by the sampling team and will be used to provide an indication of any contamination introduced during field sample preparation

Equipment (rinseate) blanks will be collected from final decontamination rinseate to evaluate the success of the field sampling team's decontamination efforts on non-dedicated sampling equipment Equipment blanks are obtained by rinsing cleaned equipment with distilled water prior to sample collection The rinseate is collected and placed in the appropriate sample containers

Procedures for monitoring field QC are provided in the sitewide QAPjP.

6.8 AIR MONITORING AND SAMPLING PROCEDURES

Air monitoring will be performed during field activities to ensure that quality data are obtained during sampling and that all sampling activities comply with the Interim Plan for Prevention of Contaminant Dispersion (IPPCD) (EG&G, 1991g) and in accordance with

EMD SOP FO 1 It is expected that the Final PPCD will be completed by the time the OU12 RFI/RI is implemented If so, compliance with the Final PPCD will be maintained

Air quality monitoring requirements for activities such as borehole drilling where there is a significant potential for producing appreciable quantities of suspended particulates include the following

- Site perimeter and community Radiological Ambient Air Monitoring Program (RAAMP) monitoring,
- Local real-time monitoring of Respirable Suspended Particulates (RSP) at individual activity work sites shall be conducted using a TSI Piezobalance Model 3500 Respirable Aerosol Mass Monitor Local RSP measurements will be used to guide the project manager's evaluation of the potential hazards associated with activity-related emissions The threshold RSP concentration for curtailing intrusive activities will be designated in the site-specific Health and Safety Plan, and
- Additional worker health and safety monitoring as required by the Site-Specific Health and Safety Plan.

As mentioned in Sections 6.0 and 8 0, one goal of the RFI/RI is to support quantitative evaluation of human health risk due to inhalation of contaminants derived from OU12 surface soils Inhalation exposure often is evaluated by direct measurement of suspended particulate concentration assuming a conservative suspended particulate concentration in ambient air Any surface soil contamination as a result of OU12 releases is expected to occur as individual sites of limited area scattered throughout the RFP 400, 600, 800 areas. As a result, suspended particulate data from air samples collected in the vicinity of OU12 sites probably would be representative of the 400, 600, 800 areas.

Total suspended particulate and respirable particulate data are collected at a monitoring station located near the RFP east gate Suspended particulate data also have been collected in the vicinity of the 903 Pad east of the 400, 600, and 800 areas, and may be collected for other RFP OU prior to or during the OU12 RFI/RI. If areas of surface soil contamination are identified at OU12 during field activities, suspended particulate data from these sources will be evaluated for applicability to OU12 inhalation exposure evaluation. If appropriate, these data will be used to provide a conservative estimate of total suspended particulates and respirable particulates in the vicinity of OU12 However, if it is determined that these data may not be representative of OU12 conditions, an OU12-specific air sampling program will be designed to provide the necessary data This air sampling program could be addressed in a TM

TABLE 6.1
OU12 IAG REQUIREMENTS/PROPOSED FSP COMPARISON

	IAG		FSP		
IHSS Number	Activity	No. of Samples	Activity	No. of Samples	Rationale
116 1	Submit ARMS Survey	NA	Submit ARMS Survey	NA	In Agreement
	G-M Survey • Radiological Survey	11	Radiation Survey • Field HPGe Survey Locations • NaI Probe • Surficial Soil • Depth Profiles[a] • Asphalt[b]	 --* 18 8 2 3	 Improved Technology Improved Coverage Improved Coverage Improved Coverage Improved Coverage
	2-inch Surface Scrapes[a]	5	Surficial Soil Samples (TAL Metals)	8	Improved Coverage
	Soil Gas Survey	11	Chemical Screening • Soil Gas • Soil Screening[c] • Ground Water Screening[c]	 8 4 2	 Optimized Placement and Coverage Analytical Real Time Data Analytical Real Time Data
			Sediment	3	Improved Coverage
	Soil Borings	5	Soil Borings Soil Samples • Volatiles • Metals, PCBs, radionuclides	2 8 8	Optimized Placement and Coverage Optimized Placement and Coverage
	Well Completion	2	Well Completion	1	Optimized Placement and Coverage

TABLE 6.1
OU12 IAG REQUIREMENTS/PROPOSED FSP COMPARISON

	IAG		FSP		
IHSS Number	Activity	No. of Samples	Activity	No. of Samples	Rationale
116.2	Submit ARMS Survey	NA	Submit ARMS Survey	NA	In Agreement
	G-M Survey • Radiological Survey	11	Radiation Survey • Field HPGe Survey Locations • NaI Probe • Surficial Soil • Asphalt[b]	 --* 7 4 3	 Improved Technology Improved Coverage Improved Coverage Improved Coverage
	2-inch Surface Scrapes[a]	4	Surficial Soil Samples (TAL Metals)	4	In Agreement
	Soil Gas Survey	11	Chemical Screening • Soil Gas • Soil Screening[c] • Ground Water Screening[c]	 4 4 2	 Optimized Placement and Coverage Analytical Real Time Data Analytical Real Time Data
			Sediment	3	Improved Coverage
	Soil Borings	4	Soil Borings Soil Samples • Volatiles • Metals, radionuclides	2 8 8	Optimized Placement and Coverage Optimized Placement and Coverage
	Well Completion	1	Well Completion	1	Optimized Placement and Coverage

TABLE 6.1
OU12 IAG REQUIREMENTS/PROPOSED FSP COMPARISON

	IAG		FSP		
IHSS Number	Activity	No. of Samples	Activity	No. of Samples	Rationale
136.1	Submit ARMS Survey	NA	Submit ARMS Survey	NA	In Agreement
	G-M Survey • Radiological Survey	58	Radiation Survey • Field HPGe Survey Locations • Surficial Soil • Asphalt[b]	--* 4 --*	Improved Technology Improved Coverage Improved Coverage
	2-inch Surface Scrapes[a]	3	Surficial Soil Samples (TAL Metals)	4	Improved Coverage
			Chemical Screening • Soil Screening[d] • Ground Water Screening[d]	4 2	Improved Coverage Analytical Real Time Data and Colorimetric Results
			Sediment	1	Improved Coverage
	Soil Borings	3	Soil Borings Soil Samples • Volatiles • Metals, radionuclides	2 8 8	Optimized Placement and Coverage Optimizted Placement and Coverage

TABLE 6.1
OU12 IAG REQUIREMENTS/PROPOSED FSP COMPARISON

	IAG		FSP		
IHSS Number	Activity	No. of Samples	Activity	No. of Samples	Rationale
136.2	Submit ARMS Survey	NA	Submit ARMS Survey	NA	In Agreement
	G-M Survey • Radiological Survey	59	Radiation Survey • Field HPGe Survey Locations • NaI Probe • Surficial Soil[b] • Depth Profiles[a]	 6 24 11 3	 Improved Technology Improved Coverage Improved Coverage Improved Coverage
	2-inch Surface Scrapes[a]	3	Surficial Soil Samples (TAL Metals)	11	Covered with HPGe
			Chemical Screening • Soil Screening[d] • Ground Water Screening[d]	 6 3	 Improved Coverage Analytical Real Time Data and Colorimetric Results
			Sediment	4	Improved Coverage
	Soil Borings	3	Soil Borings Soil Samples • Volatiles • Metals, radionuclides	2 8 8	Optimized Placement Optimized Placement
			Nested Tensiometer	1	Increased Coverage

TABLE 6.1
OU12 IAG REQUIREMENTS/PROPOSED FSP COMPARISON

	IAG		FSP		
IHSS Number	Activity	No. of Samples	Activity	No. of Samples	Rationale
157.2	Submit Radiological Survey Results 1973-1983	NA	Submit Radiological Survey	NA	In Agreement
	G-M Survey • Radiological Survey	480	Radiation Survey • Field HPGe Survey Locations • NaI Probe • Surficial Soil[b] • Depth Profile[a] • Asphalt[b]	 24 --[c] 46 12 12	 Improved Technology Improved Coverage Improved Coverage Improved Coverage Improved Coverage
	2-inch Surface Scrapes[a]	10	Surficial Soil Samples (TAL Metals)	46	Covered with HPGe
			Chemical Screening • Soil Gas Survey • Soil Screening[f] • Ground Water Screening[f]	 81 40 20	 Improved Coverage Analytical Real Time Data Analytical Real Time Data
			Sediment	3	Increased Coverage
	Soil Borings	10	Soil Borings Soil Samples • Volatiles • Metals, radionuclides	8 32 32	Optimized Placement Optimized Placement
			Well Points	10	Increased Coverage

TABLE 6.1
OU12 IAG REQUIREMENTS/PROPOSED FSP COMPARISON

	IAG		FSP		
IHSS Number	Activity	No. of Samples	Activity	No. of Samples	Rationale
187	Submit Documentation Describing Nature of Sulfuric Acid Spill	NA	Submit Documentation	NA	In Agreement
			Surficial Soils (pH) Ground Water Screening (Sulfates, pH)	5 3	Increased Coverage Increased Coverage
120.1	Submit ARMS Survey	NA	Submit ARMS Survey	NA	In Agreement
	G-M Survey • Radiological Survey	32	Radiation Survey • Field HPGe Survey Locations • NaI Probe • Surficial Soil[b] • Depth Profile[b]	 9 --[e] 9 3	 Improved Technology Improved Coverage Improved Coverage Improved Coverage
	2-inch Surface Scrapes[a]	36	Surficial Soil Samples (TAL Metals)	9	Optimized Placement
	Soil Gas Survey	32	Chemical Screening • Soil Gas Survey • Soil Screening[c] • Ground Water Screening[c]	 9 5 3	Coverage Enhanced with Real Time Analytical Data

TABLE 6.1
OU12 IAG REQUIREMENTS/PROPOSED FSP COMPARISON

	IAG		FSP		
IHSS Number	Activity	No. of Samples	Activity	No. of Samples	Rationale
	Soil Borings		Soil Borings	2	Increased Coverage
			Soil Samples • Volatiles • Metals, radionuclides	 8 8	Increased Coverage
			Well Points	3	Increased Coverage
			Nested Tensiometers	1	Increased Coverage
120.2	Submit ARMS Survey	NA	Submit ARMS Survey	NA	In Agreement
	G-M FIDLER • Radiological Survey	31	Radiation Survey • Field HPGe Survey Locations • NaI Probe • Surficial Soil • Depth Profile[a] • Asphalt[b]	 5 -- 11 1 3	 Improved Technology Improved Coverage Improved Coverage Improved Coverage Improved Coverage
	2-inch Surface Scrapes[a]	35	Surficial Soil Samples (TAL Metals)	11	Optimized Placement
	Soil Gas Survey	31	Chemical Screening • Soil Gas Survey • Soil Screening[c] • Ground Water Screening[c]	 11 6 3	Coverage Enhanced with Real Time Analytical Data

TABLE 6.1
OU12 IAG REQUIREMENTS/PROPOSED FSP COMPARISON

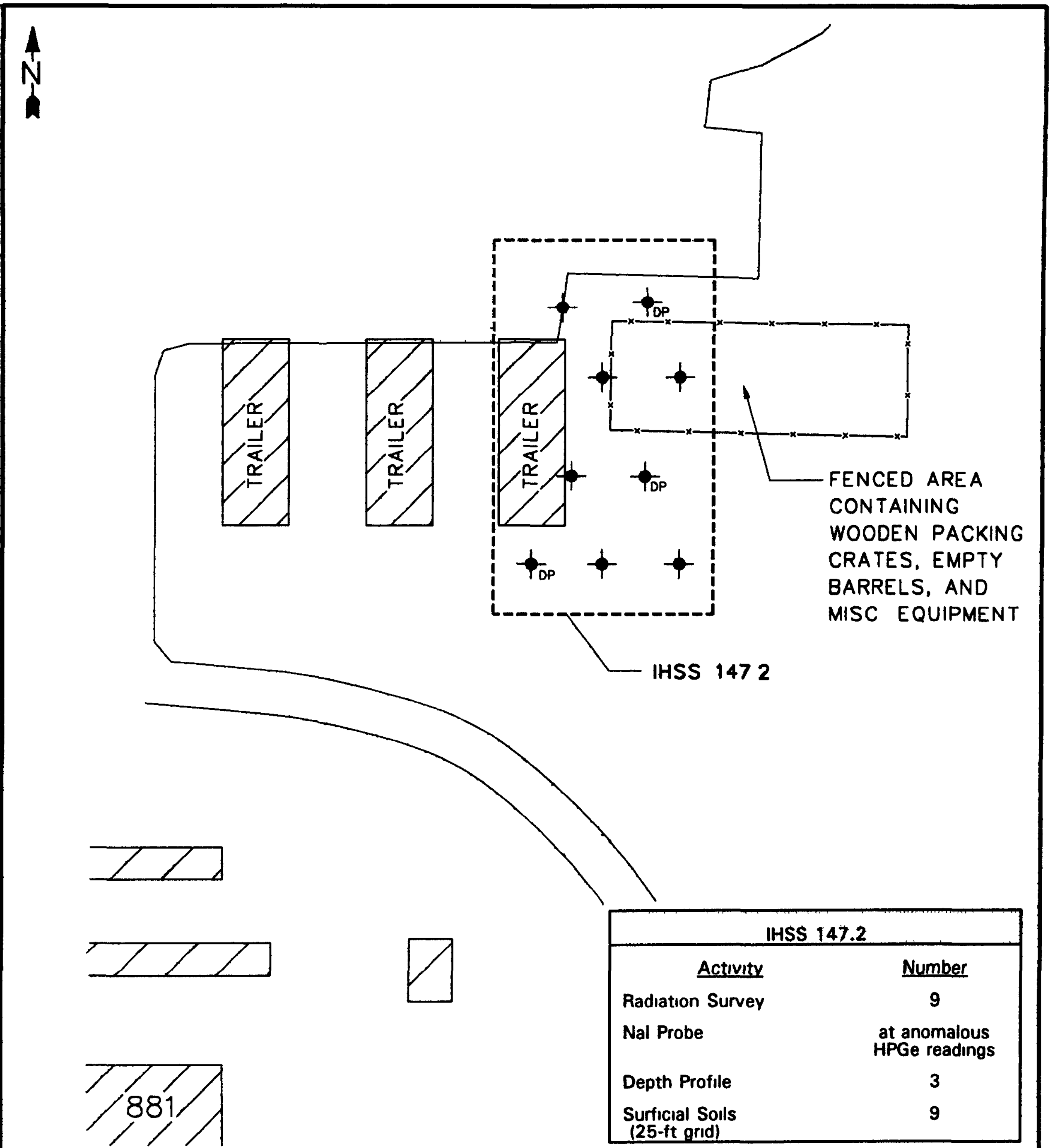
	IAG		FSP		
IHSS Number	**Activity**	**No. of Samples**	**Activity**	**No. of Samples**	**Rationale**
	Soil Borings		Soil Borings Soil Samples • Volatiles • Metals, radionuclides	2 8 8	Improved Coverage Improved Coverage
			Well Points	3	Improved Coverage
189	Submit Documentation Describing Nature of Nitric Acid Spills	NA	Submit Documentation	NA	In Agreement
			Chemical Screening • Surficial Soils (pH) • Ground Water Screening (nitrate, pH)	 5 3	 Increased Coverage Increased Coverage
147.2	Submit Documentation Describing What Conversion Activity Occurred in Building 881	NA	Submit Documentation	NA	In Agreement

TABLE 6.1
OU12 IAG REQUIREMENTS/PROPOSED FSP COMPARISON

	IAG		FSP		
IHSS Number	**Activity**	**No. of Samples**	**Activity**	**No. of Samples**	**Rationale**
			Radiation Survey • Field HPGe Survey Locations • NaI Probe • Surficial Soil • Depth Profile	 9 --[e] 9 3	 Increased Coverage Increased Coverage Increased Coverage Increased Coverage
			Surficial Soils (TAL Metals)	9	Increased Coverage

Table 6.1 Footnotes:

* Included in IHSS 157 2 Radiation Survey
[a] Collection of vertical profiles will be correlated with HPGe results Numbers and locations of profiles indicated may be revised
[b] Collection of asphalt or concrete samples will be correlated with HPGe results Numbers and locattions of samples indicated may be revised
[c] Soil and ground water screening samples will be collected based on soil gas results and analyzed for VOCs in mobile laboratory Minimum number of samples is indicated.
[d] Soil screening samples will be collected for recording evidence of staining or distrubed soil horizons Ground water screening samples will be evaluated with colorimetric methods for chromium
[e] NaI Probe locations at anomalous areas identified by HPGe survey



IHSS 147.2	
Activity	**Number**
Radiation Survey	9
NaI Probe	at anomalous HPGe readings
Depth Profile	3
Surficial Soils (25-ft grid)	9

NOTE LOCATION OF PHYSICAL SITE FEATURES ARE APPROXIMATE

EXPLANATION

- BUILDING
- IHSS BOUNDARY
- PAVEMENT
- SOIL OR GRAVEL
- FENCE
- RADIATION SURVEY
- SURFICIAL SOIL/DEPTH PROFILE SAMPLING LOCATION
- DP DEPTH PROFILE SAMPLE LOCATION

25 0 25 50 FEET

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ROCKY FLATS PLANT
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FIGURE 6-11

FIELD SAMPLING PLAN FOR IHSS 147 2-BUILDING 881 CONVERSION ACTIVITY

REVISION NO 0

FILE NAME 40103\F01-611 DWG

DATE 12/2/92

DRAWN BY EMH

APPROVED BY

CHECKED BY

CHECKED BY | APPROVED BY | DRAWN BY mh | DATE 12/2/92 | FILE NAME 40103\FC1 237 DWG | REVISION NO 0

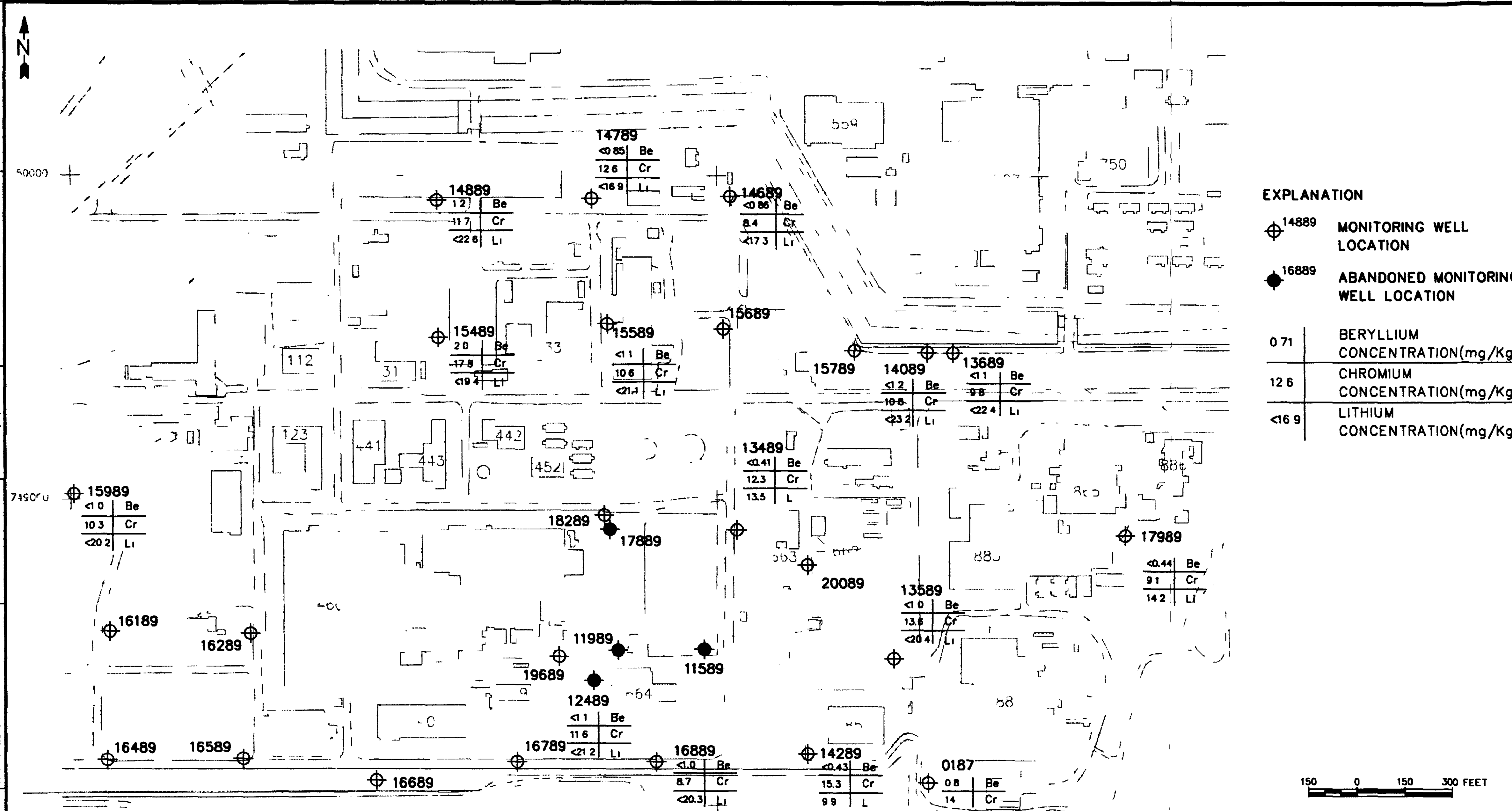

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FIGURE 2 37
SELECT METALS DETECTED IN SHALLOW SOILS(0-3 FEET DEPTH)