NOTICE

All drawings located at the end of the document.

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EG&G

ROCKY FLATS

Technical Memorandum No. 4
Addendum to Final Phase I
RFI/RI Work Plan
Operable Unit No.5

Rocky Flats Environmental Restoration Project

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FINAL
TECHNICAL MEMORANDUM NO. 4

ADDENDUM TO FINAL PHASE I
RFI/RI WORK PLAN

Surface Soil Sampling Plan - Ash Pits
Incinerator and Concrete Wash Pad

Rocky Flats Plant
Woman Creek Priority Drainage

(Operable Unit No. 5)

EG&G ROCKY FLATS, INC.
P.O. Box 464
Golden, Colorado 80402-0464

Prepared for:

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

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RFI/RI WORK PLAN TECHNICAL MEMORANDUM
APPROVAL SHEET

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Soil Sampling Plan - Ash Pits
Incinerator and Concrete Wash Pad
Rocky Flats Plant
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Approved By:

OU5,6&7 Closures Program Manager	8/4/94 Date
OU5 Project Manager	8/16/94 Date
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Approved By:

n/a
Name (Date)

1.0 INTRODUCTION

1.1 BACKGROUND

As part of the Rocky Flats Environmental Restoration program, a multiple staged Resource Conservation and Recovery Act (RCRA) Facility Investigation/Remedial Investigation (RFI/RI) is being conducted for Operable Unit 5 (OU5). Located within OU5 are Individual Hazardous Substance Sites (IHSSs) 133.1-ash pit, 133.2-ash pit, 133.3-ash pit, 133.4-ash pit, 133.5-incinerator area, and 133.6-concrete wash pad. The incinerator area, ash pits, and concrete wash pad are located south-southwest of the main security area of the Rocky Flats Plant within the Woman Creek drainage (Figure 1).

Each of the above IHSSs is being evaluated in a 4-stage effort as part of the Phase I RFI/RI Work Plan. The four stages are summarized as follows: Stage 1 - review of existing data; Stage 2 - field screening surveys; Stage - 3 surface and subsurface soil sampling; and Stage 4 - installation of groundwater monitoring wells and groundwater sampling. This Technical Memorandum addresses the Stage - 3 surface soil sampling activities.

The incinerator area (IHSS 133.5) is located along the plant's original west boundary, off of the west access road. The area occupies approximately 17,500 square feet and slopes gently to the south.

The incinerator, which was decommissioned and dismantled, had an emission stack 10 to 20-feet high and was used to burn general plant wastes, such as general combustible and noncombustible wastes between the 1950s and 1968 (Rockwell, 1988). An estimated 100 grams of depleted uranium is also believed to have been burned in the incinerator (Owen, 1973). Ashes from the incinerator were placed into the ash pits or were pushed over the side of the hill into the Woman Creek drainage and/or onto the concrete wash pad (Rockwell, 1988). A review of aerial photographs indicates that the incinerator was removed by 1971 and the entire area had begun to revegetate (U.S. EPA 1988).

The area referred to as the ash pits extends approximately 1,200 feet along an east-west axis and 500 along a north-south axis. Within this area are IHSSs 133.1, 133.2, 133.3, and 133.4, and three other suspected ash pits and one suspected ash pile. All of these have been identified through aerial photograph review and geophysical surveys (see Sections 2.1 and 2.3). The ash pits were capped with fill material and are currently covered by tall grasses.

The concrete wash pad (IHSS 133.6) occupies approximately 37,500 square feet and has an extremely irregular hummocky surface that slopes to the south toward Woman Creek. The history of the concrete wash pad has not been as well documented as the ash pits or incinerator area. It appears that this area was used to dispose of waste concrete from trucks used in the construction of the plant facilities. The concrete trucks may have been washed down in this area after each use. Potentially contaminated materials consisting of concrete debris and some ashes from the incinerator were reported to have been pushed over the side of the hill onto the concrete wash pad (U.S. DOE, 1992b).

1.2 PURPOSE AND SCOPE

A surface soil sampling program is proposed as part of the Stage 3 RFI/RI field activities. The objective of the surface soil sampling program is to identify the presence or absence of metals, polynuclear aromatic hydrocarbons (PAHs) and to confirm the results of the HPGe gamma radiation surveys conducted during the Stage 2 screening surveys.

The purpose of this Technical Memorandum is threefold and is summarized below:

- documentation of the rationale used to develop the surface soil sampling program;

- documentation of the methods that will be employed during collection of surface soil samples; and

- identification of the Stage 3 surface soil sample locations that are needed to evaluate the IHSSs 133 area.

2.0 PRELIMINARY FIELD ACTIVITIES

Stage 1 - reviews of existing data and Stage 2 - field screening surveys have been completed, or in the case of the HPGe gamma radiation survey, are entering a second stage of investigation. The results of these preliminary data gathering activities are described below.

2.1 AERIAL PHOTOGRAPH REVIEW

The object of the aerial photograph review was to substantiate the locations of the IHSSs as documented previously in Figure 7-3 of the OU5 Phase I RFI/RI Work Plan, and to determine if additional suspect sites exist that should be included in future site investigations.

The aerial photographs used for this review were those contained in the Aerial Photographic Analysis Comparison Report (APAC), prepared by the U.S. Environmental Protection Agency Environmental Monitoring Systems Laboratory in 1988 (EPA, 1988) as well as additional photographs obtained from Rocky Flats Plant photography. The photographs contained in the APAC Report were vertical, while those obtained from RFP photography were oblique. These photographs were taken in the years 1953, 1955, 1964, 1971, 1978, 1980, 1983, 1986, and 1988. The results of the aerial photograph review are discussed below.

IHSS 133.1

The area designated as IHSS 133.1 is visible in aerial photographs and its location is approximately the same as that shown in the OU5 Work Plan. Field reconnaissance of the site indicates that it consists of small amounts of dumped concrete. There were no indications of mounded or subsided cover material, or obvious changes in soil or vegetation types, and no evidence that an ash pit ever existed at this site. This finding is consistent with the conclusions of the geophysical survey described in section 2.3 of this Technical Memorandum. Based upon the available data, IHSS 133.1 is now interpreted to be a concrete dumping site and not an ash pit. A drainage ditch located to the east of IHSS 133.1 is shown under construction in a vertical photograph taken October 15, 1964. This photograph also shows a possible ash pile on the west side and south end of the drainage ditch. Oblique photographs taken on June 5, 1969 and July 1, 1969 indicate that the ash pile may have been pushed or washed down the slope. Field reconnaissance of this area disclosed that the material visible in the photographs was concrete.

IHSS 133.2

IHSS 133.2 is identifiable on oblique photographs and its location correlates well with that shown on vertical photographs. The location, as determined from both oblique and vertical photographs, does not agree with the location shown in the APAC report or with the location shown in Figure 7-3 of the OU5 Work Plan. Photographic evidence indicates that IHSS 133.2 consisted of two pits. Examination of a vertical aerial photograph taken on April 10, 1968 indicates that the initial 133.2 pit was approximately 150 feet in length and was probably half covered at the time the photo was taken. The 1968 photograph indicates that the pit was filled by direct dumping, and the material was not evenly distributed throughout the pit. A vertical aerial photograph dated August 7, 1969 shows an additional ash pit to the south at the location shown in Figure 1.

IHSS 133.3

The location for IHSS 133.3 has been revised from that shown in both the APAC report and Figure 7.3 of the OU5 Work Plan. IHSS 133.3 has been modified to include two pits within the

IHSS boundary. Vertical aerial photographs taken on October 10, 1964 and April 15, 1966 show an open trench on the north half of IHSS 133.3. A vertical photograph taken on April 10, 1968 indicates the presence of a second filled trench approximately 40 feet to the south of the original trench. The vertical photo taken on August 7, 1969 shows a large reclaimed area that was necessary to accommodate both trenches (Figure 1).

IHSS 133.4

The location of IHSS 133.4 has been revised from that shown in both the APAC report and Figure 7-3 of the OU5 Work Plan. IHSS 133.4 includes a possible surface disturbance northeast of the ash pit. The size of the ash pit and the disturbed area have been estimated from vertical aerial photographs to be 180 feet x 40 feet and 190 feet x 40 feet respectively. There are no photographs documenting the ash pit or disturbed area when they were in use.

IHSS 133.5

Vertical and oblique aerial photographs, which are dated 1966, show the incinerator while it was in operation, and its approximate location has been plotted on Figure 1. This location is essentially the same as the location shown in the OU5 Work Plan. Five photographs dated October 15, 1964; February 5, 1966; June 5, 1969; May 15, 1970; and August 1, 1975 indicate the presence of concrete rubble piles to the south of the incinerator. The occurrence of concrete rubble and metal trash at this location was substantiated during field reconnaissance of the site.

IHSS 133.6

The configuration of IHSS 133.6 as shown in Figure 1 is based on analysis of vertical aerial photographs. The site is fairly large, and the concrete appears to be the thickest along the north side where the concrete trucks may have been dumped and washed out. The location of IHSS 133.6 is consistent with the location shown in the OU5 Work Plan.

Following the aerial photo review, all sites were located on the ground using landmarks that were visible on the oblique photographs. Several of these landmarks (concrete pad, drainage ditch, etc.) are shown on Figure 1.

Additional information that was acquired from the aerial photograph review includes the part of the routes that were taken when driving into and out of two of the ash pits. An aerial photograph of Ash Pit 133.3 shows a roadway going into and out of the ash pit at the same point. An aerial photograph of Ash Pit 133.2 shows a road-way circling the ash pit with one side of the circle nearing the edge of the pit. This information suggests that the ashes were simply dumped into the pits either from within the ash pit (133.3) or from off the edge of the ash pit (133.2), and that there are no homogenous layers of ash within the Ash Pits. There is no evidence to indicate that the ash was placed in a systematic fashion (such as lifts) in the pits.

2.2 RADIATION SURVEYS

The radiation survey of the IHSS 133 area was initiated in the summer of 1992 using tripod-mounted, single crystal, high purity germanium (HPGe) gamma-ray detector instruments. A 150 foot grid pattern was used for the survey and is shown in Figures 2 and 3. This initial survey, now complete, will be followed by a second HPGe survey utilizing a multiple crystal detector instrument arranged to count activity over a larger area. In addition, a FIDLER survey will be conducted at anomalous areas identified by the two HPGe surveys.

The initial gamma radiation survey was conducted using tripod mounted HPGe instruments operating at a height of 1 meter. At this height, it is assumed that 90 percent of the detectable gamma-ray emissions originate within a counting area (field of view) having a radius of approximately six meters. The remaining 10 percent of gamma radiation detected by the HPGe is assumed to originate outside six the meter counting area. These assumptions are similar to those made for many other types of detectors, for example sodium iodide FIDLER instruments. The 150 foot grid spacing coupled with the six meter counting area give HPGe coverage of approximately five percent of the total surface area of the IHSS 133 area. This is illustrated on

Figures 2 and 3, which show the approximate area covered at each survey station as compared to the total project area. The second HPGe survey of the IHSS area will result in full coverage of the identified IHSS.

The HPGe system is used to estimate in-situ activity of radioactive elements and/or their associated daughter products. The naturally occurring elements included in the HPGe survey are uranium and thorium, and their decay products, and radioactive potassium. Because some of the elements are either weak or non-gamma emitting, their in-situ activities must be extrapolated from their respective daughter (decay) products. The accuracy of the inferred activities are therefore dependent upon the equilibrium state of each of the elements at each survey station. In this survey, the activities of radium 226 (Ra_{226}), thorium 232 (Th_{232}), and uranium 238 (U_{238}) are extrapolated (inferred) values which are expressed in picocuries per gram (pCi/g). Cesium 137 (Cs_{137}), americium 241 (Am_{241}), and plutonium 239 (Pu_{239}) were also included in the survey, with Cs_{137} being the only isotope present in measurable quantities.

2.2.1 SURVEY BACKGROUND

The initial radiation survey stations were located by a global positioning system which allows the operator to obtain the coordinates of his or her position on a real-time basis with a one to five meter accuracy. The HPGe survey stations are shown on Figure 2. Because this survey was a continuation of the radiation survey conducted over IHSS 115 (Original Landfill located immediately east of IHSS 133 and within OU5), the criteria established for that survey have been applied to the IHSS 133 area. These criteria are as follows:

- The indicated in-situ activities of Th_{232}, potassium 40 (K_{40}), and Ra_{226} were considered to be within the normal range for the Rocky Flats area. Because the indicated or inferred activities of each of these elements fell within the ranges detected in the IHSS 115 area, it is assumed that there are no anomalous occurrences in the IHSS 133 area.

- It was empirically determined in IHSS 115 that Cs^{137} activities of 0.4 pCi/g or higher were indicative of areas where the surface was relatively undisturbed. This determination is based upon a comparison of Cs^{137} data with aerial photographs showing the original topography of the area. The higher activities for Cs^{137} represent fallout that is residual in undisturbed surface soils. Lower Cs^{137} activities represent areas where surface disturbances have mixed or covered undisturbed soil with lower activity subsurface soils that were not directly exposed to fallout. This same criteria has been applied to the IHSS 133 area to identify areas associated with the individual IHSSs or other surface features, for example roads.

- Elevated in-situ activities of U^{238} were identified in IHSS 115, including one location where the source was known. However, it was not stated in the survey results what the background activities should be for the Rocky Flats area. For the initial HPGe survey in IHSS 115, apparent elevated U^{238} activities were interpreted to be related to either naturally occurring uranium or to introduced sources, based upon a comparison of the U^{238} data with the Ra^{226} survey data. Elevated in situ levels that may be related to introduced sources are considered to be anomalous.

- U^{235} activities were not determined in IHSS 115. Therefore, the same criteria used to evaluate the U^{238} data discussed above has been applied to the U^{235} occurrences in the IHSS 133 area. Anomalies are therefore based upon a comparison and interpretation of other data.

2.2.2 SURVEY RESULTS

With the exception of IHSS 133.1, the results of this survey are based on an evaluation of approximately 5 percent of the total surface area contained in the IHSS 133 area. Because there were no anomalous values detected in IHSS 133.1, the results of that survey are not included in the following discussion.

Cesium 137 (Cs^{137})

Based on the criteria established above, Cs^{137} activities of less than 0.4 pCi/g have been considered to be indicative of disturbed ground. The results of this survey were essentially predictable with low in situ activities occurring along the road; at the concrete wash pad (IHSS 133.6); at the incinerator area (IHSS 133.5), along the drainage ditch, at the IHSS 133.2 and 133.4 ash pits, and in some locations along the bank of Woman Creek. Activities exceeding 0.4 pCi/g are dominant in the east half of the area and in other areas where undisturbed ground was apparent in early oblique aerial photographs.

Thorium 232 (Th^{232})

Thorium 232 is a naturally occurring radioactive element that is not associated with production activities at the Rocky Flats Plant. Inferred activities of Th^{232} should, therefore, be related to natural occurrences, such as minerals in the alluvium or colluvium. The results of this survey indicate that the Th^{232} in situ activities range from 0.8 to 1.4 pCi/g (estimated average approximately 1 pCi/g) in the thicker alluvial sediments (north side), and increase to an estimated average of approximately 1.5 pCi/g in the exposed lower sediments. The highest inferred activities of Th^{232} appear to correlate to drainage features where deeper alluvial sediments or bedrock may be exposed.

Radium 226 (Ra226)

Radium 226 is a daughter product of U^{238} and is derived through the decay of naturally occurring U^{238}. Inferred activities of Ra^{226} are calculated from the indicated in-situ activities of lead 214 (Pb^{214}) and bismuth 214 (Bi^{214}) which occur after Ra^{226} in the U^{238} decay series. HPGe survey stations showing the highest Ra^{226} activities should approximately coincide with the highest inferred in situ activities of U^{238} if a state of equilibrium does exist.

Uranium (U^{238})

Inferred in-situ activities of U^{238} are calculated from the indicated activity of thorium 234 (Th^{234}) and protactinium 234m (Pa^{234}), which are daughter products that occur immediately after U^{238} in the decay series. The resulting U^{238} activities are shown on Figure 2. Based on the correlation of the U^{238} data with the Ra^{226} data, two stations showing elevated U^{238} activity are considered anomalous because corresponding Ra^{226} anomalies of proportional magnitude were not detected. These stations are F08 and F10 (Figure 3), with inferred in situ concentrations of 7.55 pCi/g and 21.7 pCi/g respectively. These values far exceed the elevated U^{238} activities recorded at stations that correlate to areas of elevated Ra^{226} values. Station F08 is located to the west of the IHSS 133.4 ash pit, while F10 is located between the IHSS 133.4 and IHSS 133.3 ash pits, and is downwind of the incinerator area.

Uranium 235 (U^{235})

In-situ activities of U^{238} are derived from the direct measurement of gamma-ray emissions from the U^{235} radioisotope. Elevated activity again occurs at stations F08 and F10 (0.19 and 0.375 pCi/g respectively). The elevated activity supports the probability that an introduced source, or sources, exist in the proximity of these stations. Slightly elevated levels also occur at F03 (0.148 pCi/g), G04 (0.143 pCi/g), E11 (0.161 pCi/g), and G13 (0.154 pCi/g). Each of these occurrences correspond to areas of elevated (not anomalous) Th^{232} and/or Ra^{226} activities which should be derived from naturally occurring sources.

Based upon the results of the HPGe survey, a follow-up FIDLER survey of the two U^{238} anomalies was conducted during February 1993. The approximate area covered by the FIDLER survey is shown on Figure 3. The FIDLER survey was conducted to determine whether the two HPGe anomalies are distributed sources or point sources.

One anomaly is located in an area roughly centered on HPGe survey station F10 (Figure 3) which exhibited U^{238} activity of 21.7 pCi/g. The FIDLER survey indicates that a distributed source with activity of approximately 5,000 counts per minute (cpm) occurs to the south and downslope of a small mound and depression in the topography. The area of elevated activity is approximately 35 feet wide and 76 feet long. The mound and depression are adjacent to one another and each have dimensions of about 51 feet long by 43 feet wide, and exhibit activity of 2,500 cpm which is consistent with background for the FIDLER survey. The history of the mound and depression is not known, and these features are not within the currently identified IHSS. The second anomaly (approximately 6,600 cpm) is located between HPGe sample locations E08 and F08 (Figure 3) and is associated with a small pile of metal debris. The slightly anomalous activity observed during the HPGe survey at station F08 was not corroborated by the FIDLER survey. It has not been determined whether the elevated activity detected at HPGe survey station F08 is related to the elevated activity associated with the pile of metal debris.

2.3 GEOPHYSICAL SURVEYS

Electromagnetic (EM) and magnetic field surveys conducted over the IHSS 133 area were completed in mid-December 1992. The following preliminary data covering the entire IHSS 133 area were used in preparing this Technical Memorandum:

- EM31 vertical dipole conductivity survey;
- EM31 in phase survey;
- Total magnetic field survey;
- Magnetic gradient survey; and
- Draft map showing the surface features (concrete dumps, slabs, etc) encountered during the survey traverse.

Both the EM and the magnetometer surveys were partially successful in delineating or confirming the indicated locations of most of the individual IHSS's in the project area. A power line crossing the area from west to east, and a branch line which turns to the north and is located just to the west of the incinerator site, caused interference with the magnetic survey. Usable data were acquired over the IHSSs that are located far enough from the power lines to allow magnetic measurements of sufficient intensities to override the interference produced by these lines.

Field reconnaissance conducted during the geophysical surveys provided information that has been incorporated into Figure 1. Because the traverse was tied to land surveyed base lines, landmarks such as the concrete pad located just to the west of IHSS 133.1 have been more accurately located on Figure 1. Since most of the features shown on the west half of the map were located from this pad and other landmarks that could be easily identified on the vertical aerial photographs, adjustments were subsequently made to some of the IHSSs and other prominent features located on the west side of the map. These changes have resulted in improved correlations of some surface features with anomalies occurring on the EM and magnetic contour maps. The preliminary results of these surveys are discussed on an IHSS by IHSS basis below.

IHSS 133.1

The presence of IHSS 133.1 was not substantiated by either the EM or magnetometer surveys of the area. An on site examination of the area found only small amounts of dumped concrete with no other indications of any surface disturbance such as mounding or slumping of cover materials or obvious changes in soil and vegetation types. Based upon these findings, the current interpretation of the IHSS 133.1 area is that the site was used to dispose of concrete and not used as an ash pit.

IHSS 133.2

IHSS 133.2 has been expanded to include a previously undesignated area to the south of the power lines with a slightly larger area (200 feet by 40 feet) than was indicated for the original 133.2 ash pit. This interpretation is consistent with the aerial photographic evidence for IHSS 133.2 described in section 2.1 of this Technical Memorandum. Although both the north and south areas are located within close proximity of the power lines, the total magnetic field data indicate a typical magnetic response to buried magnetic objects indicating the presence of metallic debris in the north pit. These magnetic data over the south pit are obscured by the power line interference, but it is conceivable that metallic debris exists in this area. These EM conductivity data do not delineate the trenches or disturbed ground in either area.

IHSS 133.3

The geophysical survey could not corroborate the photographic evidence for two ash pits at this site because data over the northern pit was distorted by power line interference. These total magnetic field data indicate well defined magnetic anomalies that correspond to the location of the southern-most pit shown on Figure 1. The configuration and sizes of the anomalies indicate that metallic debris was not uniformly distributed throughout the trench.

Conductivity at IHSS 133.3 was measured using an EM31 in both a vertical and horizontal dipole mode. The vertical dipole conductivity, which was used exclusively to interpret the conductivity of the area, measures the conductivity of an induced electromagnetic field to determine the conductivity of the earth at a predetermined depth range (depending upon the horizontal spacing of the coils of the instrument being used). A high instrument response indicates the presence of a high conductivity material, which can include; highly conductive groundwater, the presence of metallic debris, or a buried strata that is more conductive than the overlying or surrounding sediments. These preliminary EM survey data define an area of relative high conductivity which is interpreted to be related to the varying moisture content of alluvial sediments. The sediments can vary from clay to gravel within the general area. The conductivity data do not delineate the trenches identified on the aerial photographs because the material filling the trenches, and the sediments surrounding the trenches may have a similar moisture content. Although these data do not delineate the trenches, the overall disturbed area can be readily identified on the ground.

IHSS 133.4

IHSS 133.4, as shown on Figure 1, has been expanded to include a possible surface disturbance extending to the northeast from the trench area. These EM data were successful in delineating the disturbed area and were used to make a slight site location adjustment which was incorporated into Figure 1. A well defined, elongated magnetic anomaly was recorded over IHSS 133.4 indicating the presence of magnetic debris within the east-west pit. These data indicate a moderately uniform distribution of metallic debris throughout the trench. No significant anomalies were detected over the northeast area which is subject to EMF interference from the power lines.

IHSS 133.5

IHSS 133.5, which includes the old incinerator site, consists of a broad area covered with gravel and cement rubble piles with scattered metallic debris. EM anomalies coincide with the plotted location of the incinerator suggesting that portions or all of the foundation and floor may have been left in place when the incinerator was demolished.

These EM vertical dipole conductivity data clearly define the topography of the area and the previously existing road that was located below the incinerator. The floor and foundation of the incinerator occur as a rectangular shaped low conductivity anomaly surrounded by a high conductivity halo in both the EM conductivity data and the in phase data. Topography can be interpreted from the EM conductivity data because the topographic highs are shown as low conductivity areas (presumably due to a greater thickness of coarser unsaturated alluvial material) and the drainage ways and topographic lows are shown as higher conductivity areas (composed of mixed alluvial sediments with greater moisture content).

These magnetic data vary from good to questionable because of the north-south power lines that cross the site on the west side. Weak anomalies occur that approximately coincide with the incinerator site and may be attributed to the reinforcement bar in the foundation. Other anomalies occurring in the vicinity of the incinerator site, which are assumed to be far enough away from the power lines to override any interference, are attributed to shallow or surface metallic debris.

IHSS 133.6

IHSS 133.6 encompasses the concrete wash pad area which was partially delineated by the EM survey. These vertical dipole conductivity data indicate an area of low conductivity that is interpreted to be coincident with the area of thick concrete cover. These data then grade into a higher conductivity that is most likely indicative of alluvial sediments that are either more conductive or have a greater moisture content than those that underlie the dump area. The conclusion that the areas of higher conductivity are due to the presence of greater moisture content or finer grained alluvial sediments, and not areas where the depth to bedrock is less, is based on the correlation of conductivity values in areas where the bedrock is known to be shallow, as compared to the conductivity values that were recorded in areas where damp to saturated alluvial sediments are believed to exist. The relative conductivity in areas of shallow bedrock ranged from 34.5 to 42.5 millimohs (mmohs) per meter, while the recorded conductivity in the areas of suspected damp to saturated alluvial sediments exceeded 55 mmohs/meter.

A strong magnetic anomaly occurs along the north side of the area that generally appears to be outside of the interference from the power lines. Continuing to the south, this anomaly grades into a band showing lower magnetic intensities. The perimeter of the site was then mapped at background levels with no significant anomalies. Based upon those data described above and the photographic evidence discussed in section 2.1 of this Technical Memorandum, it can be assumed that some magnetic metallic debris was buried or dumped along the north half of the site.

2.4 ADDITIONAL INVESTIGATIONS

Interviews were conducted in an attempt to acquire information about the operational history of the ash pits. Employees who worked at the ash pits during the early 1960s, indicated that the ashes were collected at the incinerator in a dumpster. The dumpster was then transported to the ash pits and dumped. The ashes were not spread, and presumably, there are not homogenous layers of ash in the ash pits.

3.0 SURFACE SOIL SAMPLING PROGRAM

3.1 STATISTICAL METHODOLOGY FOR SAMPLING

Two surface soil sampling plans are proposed. First a metals/PAH/radionuclide surface soil sampling plan is proposed to identify elevated concentrations of metals, PAHs and to confirm the results of the HPGe surveys for radionuclides in surface soils within the IHSS 133 area. Sample data may be used for an OU wide exposure point concentration for risk assessment if no elevated concentrations are identified and if the calculated statistical power is within an acceptable range. Second a radiation anomaly surface soil sampling plan is proposed to assess areas of elevated activity that will be identified after the radiation surveys are completed and these survey data evaluated.

The metals/PAH/radionuclide surface soil sampling plan for IHSS 133 will use judgmental sampling methods, based on historical information and Stage 2 survey results, in combination with random sampling methods to bias the samples and improve detection of contaminants. Surficial soil samples will be collected at areas immediately downwind of the ash pits, and downslope of the concrete wash pad (judgmental samples). The remaining surficial soil samples will be collected randomly in the areas between the individual IHSSs. Soil samples will be analyzed for target analyte list (TAL) metals, PAHs, total organic carbon (TOC) and the radioanalytes listed in Table 1.

Radiation anomalies delineated from the completed HPGe survey will not be evaluated during implementation of the metals/radionuclide surface soil sampling plan. The results from the completed HPGe survey will be combined with the 100 percent coverage HPGe survey currently being conducted. Any anomalies will be FIDLER surveyed to assess whether the activity is related to a distributed source or a point source. The results of the HPGe surveys and the FIDLER survey will be used to design a surface soil sampling plan to characterize the anomalies. Samples collected for the radiation anomaly surface soil sampling plan will be analyzed for the

TABLE 1
IHSS 115
ANALYTICAL PARAMETERS

TARGET ANALYTE LIST - METALS	DETECTION LIMITS* Soil (mg/kg)
Aluminum	40
Antimony	12
Arsenic	2
Barium	40
Beryllium	1.0
Cadmium	1.0
Calcium	2000
Cesium	200
Chromium	2.0
Cobalt	10
Copper	5.0
Cyanide	10
Iron	20
Lead	1.0
Lithium	20
Magnesium	2000
Manganese	3.0
Mercury	0.2
Molybdenum	40
Nickel	8.0
Potassium	2000
Selenium	1.0
Silver	2.0
Sodium	2000
Strontium	40
Thallium	2.0
Tin	40
Vanadium	10.0
Zinc	4.0

TABLE 1 - Continued
IHSS 115
ANALYTICAL PARAMETERS

POLYNUCLEAR AROMATIC HYDROCARBONS	DETECTION LIMITS Soil (ug/kg)
Acenaphthene	330
Acenaphthylene	330
Anthracene	330
Benzo(a)anthracene	330
Benzo(a)pyrene	330
Benzo(b)fluoranthene	330
Benzo(k)fluoranthene	330
Benzo(ghi)perylene	330
Chrysene	330
Dibenzo(a,h)anthracene	330
Fluoranthene	330
Flourene	330
Indeno(1,2,3-cd)pyrene	330
Naphthalene	330
Phenanthrene	330
Pyrene	330

TABLE 1 - Continued
IHSS 115
ANALYTICAL PARAMETERS

RADIONUCLIDES	DETECTION LIMITS* Soil (pCi/g)
Gross Alpha	4 dry
Gross Beta	10 dry
Uranium 233+234, 235, and 238 (each species)	0.3 dry
Americium 241	0.02 dry
Plutonium 239+240	0.03 dry

* Detection and quantitation limits are highly matrix dependent. The limits listed here are the minimum achievable under ideal conditions. Actual limits may be higher.

OTHER PARAMETERS	DETECTION LIMIT
Total Organic Carbon	1 mg/kg

radioanalytes listed in Table 1. An addendum to this Technical Memorandum will be issued after the HPGE and FIDLER surveys are completed. The addendum will provide details for the radiation anomaly sampling plan and describe how the radiological samples collected during the first round of sampling will be integrated with radiological samples collected during the second round of sampling. A brief discussion is provided below detailing the methods used to obtain the number and location of samples for the metals/PAH/radionuclide surface soil sampling plan.

A statistical relationship exists between confidence levels, powers, minimum detectable relative differences, coefficients of variation, and sampling sizes. These are defined as (EPA, 1990):

- **Confidence Interval** - one hundred minus the confidence level is the percent probability of finding contamination when no contamination is present (Type I error, or false positive).

- **Power** - one hundred minus the power is the percent probability of not finding contamination when contamination is present (Type II error, or false negative).

- **Minimum Detectable Relative Difference** - percent difference required between site and background concentration levels before the difference can be detected statistically.

- **Coefficient of Variation (CV)** - the standard deviation divided by the mean.

The formula used to calculate the number of surface soil samples for the IHSS 133 area is given below (EPA, 1989a):

$$n \geq \left[\frac{(Z_{\alpha} + Z_{\beta})}{\frac{M}{CV}} \right]^2 + 0.5\, Z_{\alpha}^2$$

WHERE: n = minimum number of samples needed to statistically detect the difference between site and background concentration levels;

Z_{α} = one sided Z-value at an α level of significance (obtained from normal distribution statistical tables);

Z_{β} = one sided Z-value at a β level of significance (obtained from normal distribution statistical tables);

CV = coefficient of variation;

M = minimum relative detectable difference.

The coefficient of variation is usually estimated from historical data. Because insufficient historical data exist to calculate the coefficient of variation, an assumption was made that the coefficient of variation will be approximately 40 percent. The confidence level, power and minimum relative difference were set to meet the minimum EPA recommended performance measures for risk assessment: confidence (80 percent), power (90 percent), and minimum detectable relative difference (20 percent).

Figure 4 shows power curves that vary by sample size for coefficients of variation ranging from 20 percent to 80 percent. The power curves used a set confidence of 80 percent and the "ability to detect a difference from background" of 20 percent. The percent of power then varies with the number of samples taken. Eighteen surface soil samples will be taken in the IHSS 133 area.

If the CV is 40 percent or less, over 90 percent power will be achieved. If the CV is between 40 percent and 60 percent, then 75 percent to 90 percent power will be achieved.

After the data are collected, the coefficient of variation along with the power will be calculated to determine if enough samples were collected to meet preliminary risk assessment guidelines. The sampling plan is biased to find elevated concentrations; therefore, if no elevated concentrations are found, the population can be assumed to be in "random order" and the estimates of the mean, variance, confidence limits, etc. will be identical to a random sampling plan (Gilbert, 1978). Depending on whether elevated concentrations are detected, additional surface soils may need to be collected to support the data requirements for a preliminary risk assessment.

Of the eighteen samples, seven were placed downwind of the identified IHSSs in the 133 area. Because the ash pits were not covered daily, the ash was exposed to strong winds that are common at the Rocky Flats plant site. After each ash pit was filled with ash it was eventually covered with soil, therefore it is believed that the most likely surface sources of ash pit contamination remaining today are those areas immediately downwind of the ash pits and areas where the cover has been breached by burrowing animals, erosion or vehicle traffic. Field reconnaissance does not indicate that the cover has been breached; therefore contamination from windborne dispersion of the ash will be the primary focus of the judgmental surface soil sampling program. Analysis of a Rocky Flats wind rose diagram (Figure 5) indicates that the primary wind direction is from the west-northwest. Based on this information, one surface soil sample location was set approximately 50 feet (determined suitable based on the 133 area maps and on site conditions) directly east-southeast from a point on the southeast border of each of the identified IHSSs. The reference point that was used on a southeast IHSS border was either a border intercept point or a randomly selected point (for rounded/curved borders). A total of seven samples were placed downwind of the IHSSs. No sample was positioned downwind of the suspected ash pile area located to east of IHSS 133.1 because field reconnaissance indicates that the material disposed of at this location was actually concrete.

The remaining eleven samples were randomly selected throughout the IHSS 133 area to evaluate potential windborne contamination from the incinerator stack, ash pits and ash pit delivery routes. Grid points were used from the completed HPGe survey of the 133 area and eleven grid points were randomly selected using a random number generator. The grid intersections were designated as the sampling locations. Grid intersections that were located within any of the IHSS/potentially contaminated regions (for example, suspected ash pile or the known radiation anomalies) or outside of the OU5 133 area boundaries were exempted as sampling locations.

By placing the eleven random samples at grid points based on the HPGe survey, a comparison can be made between radionuclide activity achieved by the HPGe survey and those achieved in the analytical laboratories. If a correlation exists between the two methods, it will be possible to obtain a more precise estimate of the overall population mean by using both sets of measurements as opposed to using only the eighteen analytical measurements. The 100 percent HPGe survey currently being conducted will provide radionuclide activities which may be compared with laboratory results from the biased samples collected downwind of each IHSS.

The eighteen sampling locations are illustrated on Figure 6. State plane coordinates for each of the proposed sample locations are listed in Table 2. Sample locations will be identified in the field by means of a compass, measuring tape, and surveyed markers installed as part of the radiation survey and ash pit field location activities. The location of each random sample will be staked at the time the sample is collected and land surveyed at a later date.

Additional Soil Sampling Investigations

One soil profile sample will be collected from the location of each of two HPGe survey stations to corroborate the HPGe survey results with respect to depth (Figure 6). Profile samples will be collected in accordance with EG&G Operating Procedure GT.8 Document Change Number 5-21000-OPS-GT.8-92.R2-93.02. Surface profiling obtains discrete soil samples from depths up to six inches. Each discrete sample represents soil from an interval of two inches in depth, for example, from the ground surface to two inches deep, from two to four inches deep and from four to six inches deep. Profile samples will be collected from the ground surface downward in two inch increments as described above using a stainless steel trowel. Sufficient material will be collected to fill a 500 milliliter container for laboratory analysis of the radioanalytes listed in Table 1.

One of the profile samples will be collected at HPGe survey station F10 (Figure 3) where U^{238} activity was 21.7 pCi/g (Figure 2). The second profile sample will be collected at HPGe survey station B17 (Figure 3) which was not anomalous for any of the radionuclides counted. The coordinates of the profile sample locations are given in Table 2 and Figure 6 shows the proposed profile sample locations (sample numbers 11 and 20).

Subsurface borehole sampling within the individual IHSSs is also being conducted as part of the Stage 3 investigations. The details of that sampling program are discussed in Technical Memorandum 7 (DOE, 1993). Eight surface soil samples have already been collected in the OU5 area; these samples will be analyzed for radionuclides and target analyte list (TAL) metals. The eight samples were collected to support environmental studies of vegetation and small mammals. Locations for five of the eight samples are in the vicinity of the 133 area and are shown on Figure 6. The three remaining surface soil samples that have already been collected are located in the vicinity of IHSS 115 and are not shown on Figure 6. These samples have been collected using the Rocky Flats surface soil sampling methods described in EG&G Operating Procedure GT.8. These samples will be analyzed for metals and a suite of radioanalytes.

3.2 FIELD PROCEDURES

Field procedures for collecting surface soil samples are specified in EG&G Operating Procedure GT.8 (EG&G, 1992a). Samples collected for both radiological and conventional analyses will

TABLE 2

PROPOSED SURFACE SOIL SAMPLE LOCATION NUMBERS AND STATE PLANE COORDINATES

Sample Location No.	North Coordinate	East Coordinate
SS500193	747715	2079095
SS500293	747265	2079245
SS500393	747339	2079266
SS500493	747594	2079454
SS500593	747565	2079545
SS500693	747265	2079545
SS500793	747351	2079569
SS500893	747865	2079695
SS500993	747715	2079695
SS501093	747565	2079695
SS502193*	747565	2079695
SS501193***(F10)	747415	2079695
SS501293	747565	2079845
SS501393	747743	2079864
SS501493	747565	2080145
SS501593	747391	2080201
SS501693	747865	2080595
SS501793	747415	2080595
SS501893	747620	2080684
SS501993	747515	2080690
SS502093***(B17)	748015	2080745
SS502293*	747015	2080745
SS502393**	Not Applicable	Not Applicable

* - Duplicate sample
** - Rinsate sample
*** - Profile soil sample for corroboration of HPGe survey results with HPGe survey station number.
Sample location numbers correspond to those shown on Figure 4 as follows: SS500_1_93 is sample 1 on Figure 4.

be collected according to the Rocky Flats method, Section 5.0 of GT.8 (EG&G, 1992a). Equipment needed for surface soil sampling is specified in GT.8 (EG&G, 1992a). Decontamination will be in accordance with EG&G Operating Procedure FO.3 (EG&G, 1992b). Sample labeling, shipment, and preservation will be conducted according to EG&G Operating Procedures FO.13 (EG&G, 1992c). Sample designations, documentation, data package preparation, and sample tracking will be in accordance with EG&G Operating Procedure FO.14 (EG&G, 1992d). Data Reduction, Validation, and Reporting will be in accordance with Section 3.9 of the Quality Assurance Addendum to the OU5 Work Plan (DOE, 1992) and Section 3.4 of the Quality Assurance Project Plan (EG&G, 1991).

A summary of surface soil sampling field methods is provided below. Details of the methods are given in the EG&G Operating Procedures.

1.0 The radiation survey results must satisfy the pre-work area radiation monitoring requirements - SOP FO.16.

2.0 The following decontamination equipment must be assembled for field use as required by FO.3: liquinox, bristle brushes (all plastic), Rocky Flats Plant tap water or distilled water, non-reactive plastic wrap, plastic wash and rinse tubs, plastic sheeting for use as a ground cloth, and paper towels.

3.0 The following sampling equipment must be obtained as required by FO.13: sample glassware with preservative (see Table 4), coolers, thermometer, blue ice, sample labels, chain of custody forms, custody seals, zip-lock bags, bubble wrap, vermiculite, strapping tape, clear tape, a carboy for transport of rinsate, and the forms included in Appendix I of this document.

Surface soil samples will be collected according to the Rocky Flats method. The following sample collection equipment must be obtained as required by GT.8: soil sampling jig (10 x 10 x 5 cm), spare sampling jig parts, stainless steel scoop, brushes, wire, paint, new 1 gallon metal paint cans, hammer, miscellaneous cold chisels, pointed cement trowel, black waterproof marking pens, metric rule, wood block (10 x 10 x 30 cm), site selection plan, health and safety equipment including PID and radiation survey instrument, and logbook.

4.0 Sampling equipment will be decontaminated in accordance with FO.3. Disposal of decontamination water shall be in accordance with FO.7, Section 6.1.1. Steam cleaning of sample coolers and previously used disposal drums is required.

5.0 Sampling sites will be located using a steel tape, compass and survey monuments; coordinates for the sample locations are given in Table 3 of this document. Surface soil samples for radiological and conventional analyses will be collected in accordance with the Rocky Flats method, GT.8, section 5.2.3. Briefly, this method consists of compositing five sub-samples collected from the center and each corner of a one-meter square at each of the sampling locations shown in Figure 6. Each of the five sub-samples will be collected by driving a 10 x 10 x 5 centimeter stainless steel sampling jig to a depth of 5 centimeters, then a stainless steel scoop will be used to extract the jig and 500 cubic centimeters of soil. Each sub-sample will be placed into a stainless steel pan and thoroughly mixed with the other sub-samples before the composite sample is collected.

All sampling activities will be documented in a field logbook and on forms GT.8A and GT.8B. Documentation will include the following items listed in EG&G Operating Procedure FO.13 section 6.4: sampling activity name and number, sampling point name and number, sample number, name(s) of collector(s) and others present, date and time of sample collection, sample container tag/label number (if appropriate), preservative(s), requested analyses, sample matrix, filtered or unfiltered, designation of QC samples, collection methods, chain of custody control numbers, field observations and measurements during sampling, and signature.

Samples will be processed for shipment in accordance with FO.13 and the chain of custody (COC) form will be completed and a COC number assigned to it.

6.0 Field equipment will be decontaminated in between sample locations in accordance with FO.3; disposal of the leftover rinsate will be in accordance with FO.7, Section 6.1.1.

7.0 The data tracking process will be in accordance with FO.14 using form FO.14A. The data entry process will be as prescribed on forms FO.14C, FO.14H and FO.14K.

3.3 ANALYTICAL PARAMETERS

Based upon the types of waste that may be present in the IHSS 133 area, each surface soil sample shown in Figure 6, excepting the profile samples, will be analyzed for TAL metals, PAHs, total organic carbon (TOC), and a suite of radioanalytes specified in Table 1. Profile samples will be analyzed only for the radioanalytes listed in Table 1. After the IHSS 133 area has received 100 percent HPGe survey coverage and any anomalies have been further evaluated with a FIDLER survey, soil samples collected from radiation anomalies and the samples will be analyzed for the suite of radioanalytes specified in Table 1. All analytical work will be conducted by an EG&G contract laboratory. Holding times, preservatives, and sample containers for each of the analytes are shown in Table 3.

TABLE 3

ANALYTES, SAMPLE CONTAINERS, PRESERVATIVES AND HOLDING TIMES

Analyte	Container	Preservative	Holding Time
TAL Metals	Soil - 8oz. wide mouth glass jar.	None	6 months[a]
	Rinsate - 1 liter plastic bottle.	Nitric acid pH < 2 and Cool 4° C	6 months[a]
PAHs	Soil - 8oz. wide mouth glass jar.	.008% $NA_2S_2O_3$	7days extraction/40 days after extraction
TOC	Soil - 8oz. wide mouth glass jar.	Cool 4° C	28 days
Radiological Tests - gross alpha, gross beta, $U^{233/234}$, U^{235}, U^{238}, $Pu^{239/240}$, Am^{241}	Soil - 500 mL wide mouth glass jar.	None	None
	Rinsate - 3 x 4 liter plastic containers.	Nitric acid pH < 2	6 months

[a] Holding Time for Mercury is 28 days.

4.0 REFERENCES

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DOE, 1993, Draft Final Technical Memorandum 7, Addendum to Final Phase I RFI/RI Work Plan, Soil Boring Sampling Plan - Ash Pits 1-4, Incinerator and Concrete Wash Pad, Rocky Flats Plant, Woman Creek Priority Drainage, January 1993.

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EG&G, 1992b, Environmental Management Department (EMD) Manual Operation Standard Operating Procedure (SOP) FO.3, Revision 2, General Equipment Decontamination, March 1, 1992.

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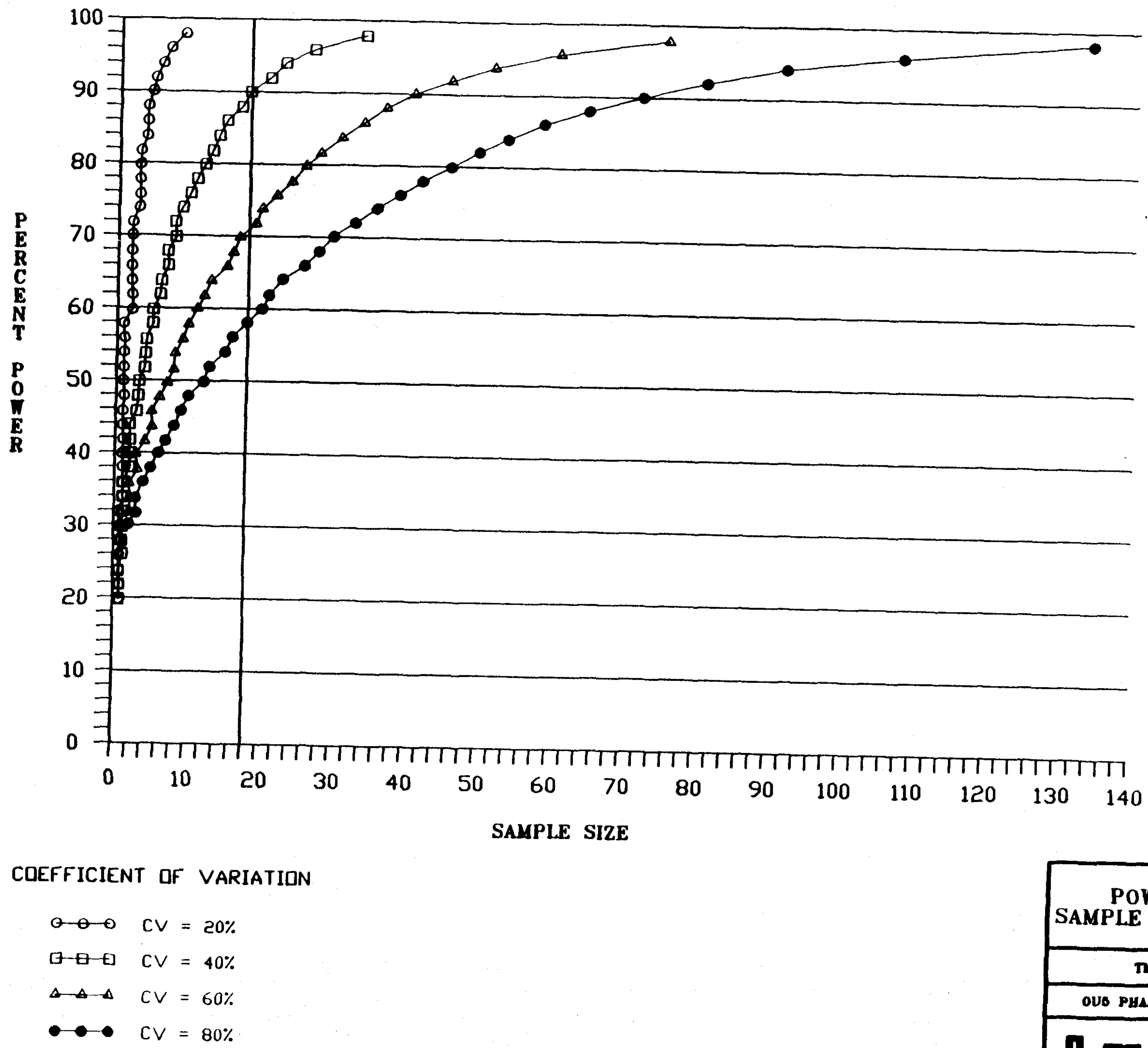
FIGURES



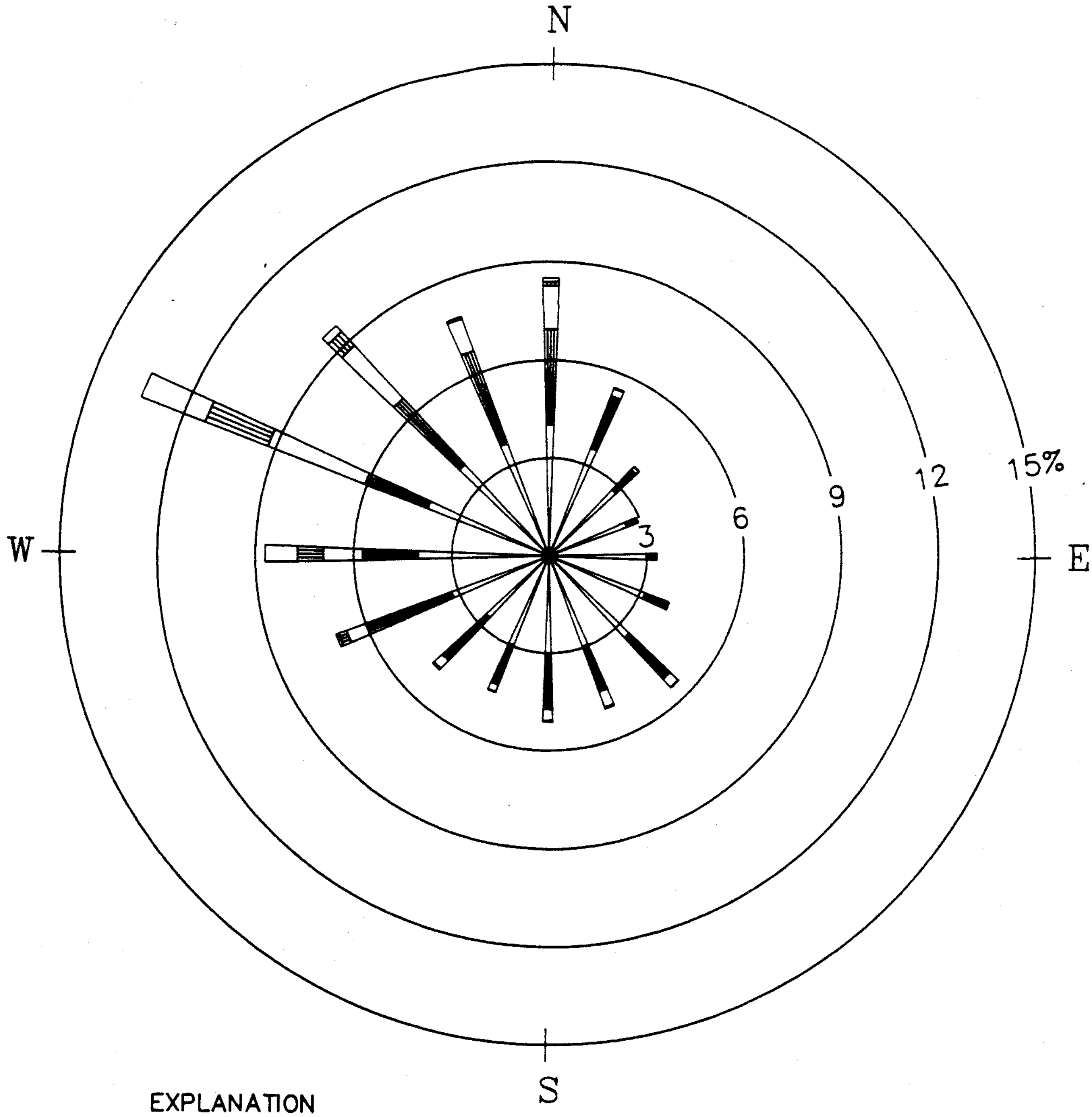
POWER CURVES FOR SAMPLE SIZE CALCULATION

TM4 - IHSS 133.3 AREA

OU5 PHASE I RFI/RI IMPLEMENTATION

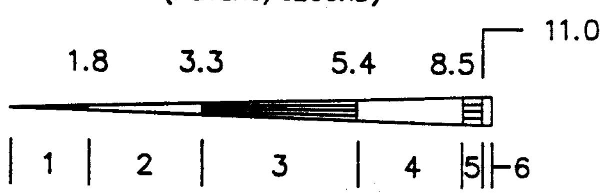
9208.15.01.14

FIGURE 4



EXPLANATION

WIND SPEED
(METERS/SECOND)



WIND SPEED CLASSES

NOTES:
DIAGRAM OF THE FREQUENCY OF OCCURRENCE FOR EACH WIND DIRECTION.
WIND DIRECTION IS THE DIRECTION FROM WHICH THE WIND IS BLOWING.
EXAMPLE: WIND IS BLOWING FROM THE NORTH 8.5 PERCENT OF THE TIME.

ROCKY FLATS PLANT WIND ROSE 7/89 - 6/90		
TM4 - IHSS 133.3 AREA		
OU5 PHASE I RFI/RI IMPLEMENTATION		
EG&G	9208.15.01.14	FIGURE 5

APPENDIX I

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM FO.16A (REV. 2)

RESULTS OF RADIOLOGICAL MEASUREMENTS IN THE FIELD

Project Name: ______________________________

Date: ______________ Site Number: ______________________

Snow Cover Present (Y/N): ______________ Work Surface Wet (Y/N): ____________

1. Instruments Used and Background Readings

Manufacturer and Model No.	Serial Number	Probe Type	Probe Serial No.	Calibration Due Date	Background Reading (cpm)

2. Prework Monitoring Results (Ludlum 12)

_______ cpm at Point of Intrusive Activity _______ Highest Measured cpm

3. Sample Monitoring: Intervals Monitored and Associated Samples

Depth Interval (Ft)	Highest Level Noted (cpm)	Associated Sample Numbers

Completed By: ______________________________
Print Name Signature Date

Subcontractor: ______________________________

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM FO.16B (REV. 2)

RESULTS OF RADIOLOGICAL MEASUREMENTS IN THE FIELD

Project Name: ______________________________

Date: ______________ Site Number: ______________________

Snow Cover Present (Y/N): ______________

1. Instruments Used and Background Readings

Manufacturer and Model No.	Serial Number	Probe Type	Probe Serial No.	Calibration Due Date	Background Reading (cpm)

2. PPE Monitoring

_______ PPE monitoring not required. Work area was characterized as uncontaminated and field radiological screening as work progressed did not indicate the presence of potential contamination.

If PPE monitoring required complete the following table

Ludlum Model 12	Bicron Analyst Fidler	PPE screening resulted in verived positive reading (Y/N)	Time	PPE Verified positive reading (cmp)	Smear No.

Completed By: ______________________________

Print Name — Signature — Date

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANTS FORM GT.8A (REV. 2)

SURFACE SOIL
DATA COLLECTION FORM

Sample Number ______________________

Collection Date ______________________

Collection Time ______________________

Location Code ______________________

Chain of Custody No. ______________________

Coordinates North or Y ______________________ East or X ______________________

Sample Location ______________________

Composite (Y/N) ______________________

Composite Description ______________________

Collection Method ______________________

Sample Team Leader ______________________

Sample Team Member ______________________

Sample Team Member ______________________

Sample Team Member ______________________

Container Size (Oz) ______________________ % Full ______________________

Comments ______________________

____

____

____

____

____

____

____

____

____

Completed By: ______________________

Print Name Signature Date

Subcontractor: ______________________

SURFACE SOIL SAMPLING FIELD ACTIVITIES REPORT

Project Name ______________________________

Site Identification ____________________ Date ____________

Sampler ______________________________

SAMPLE POINT	GRID LOCATION	TIME	COMMENTS

Completed By: ______________________________

Print Name Signature Date

CONTRACTOR ______ SAMPLERS ______ PROJECT # ______

LAB/LOCATION ______

SITE CONTACT/PHONE ______

C-O-C NUMBER

EG&G ROCKY FLATS, CHAIN OF CUSTODY

DATE/TIME	SAMPLE NUMBER	LOCATION	CONTAINER TYPE	NUMBER OF CONTAINERS	MEDIA SOIL(S) WATER (W)	FILTERED=F POT DISS=P	TURN AROUND RUSH =R	OUT OF SPEC REPORTS

PRESERVATIVE	
COOLED TO 4 C	
Zn(C2H3O2)2	
NAOH	
HNO3	
H2SO4	

Analysis	BOTTLE CODES		
VOA - CLP	V		
VOA - 502.2	V	D	C
BNA - CLP	B	A	R
PCB's/PEST. - CLP	P		
CLP TOTAL METALS(1)	M		
CLP DISS. METALS(1)	M	*	
WATER QUALITY (2)	W	A	
NO3/NO2 as N	W	B	C
Tot. Phosphate, NH4	W	B	D
OIL & GREASE	W	C	
Ortho-Phosphate	W	D	A
NO2	W	D	B
CYANIDE	W	E	
TOC	W	H	
DOC	W	I	
H2S	W	J	
Cr IV	W	K	

RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME

LABORATORY USE ONLY	Y	N
PCKG REC'D/CUSTODY SEALS INTACT		
SAMPLE LABELS/COCs AGREE		
TEMPERATURE WITHIN SPECIFICATION ______ C		
CORRECTED COPY ATTACHED		
PROBLEMS OR DISCREPANCIES		

REMARKS (1) INCLUDES Cs,Li,Sr,Mo,Si,Sn
(2) TSS,TDS,Cl,F,SO4,CO3,HCO3

SHIPMENT METHOD

CONTRACT ... ______ SAMPLERS ______ PROJECT # ______

LAB/LOCATION ______

SITE CONTACT/PHONE ______

C-O-C NUMBER

EG&G ROCKY FLATS, CHAIN OF CUSTODY

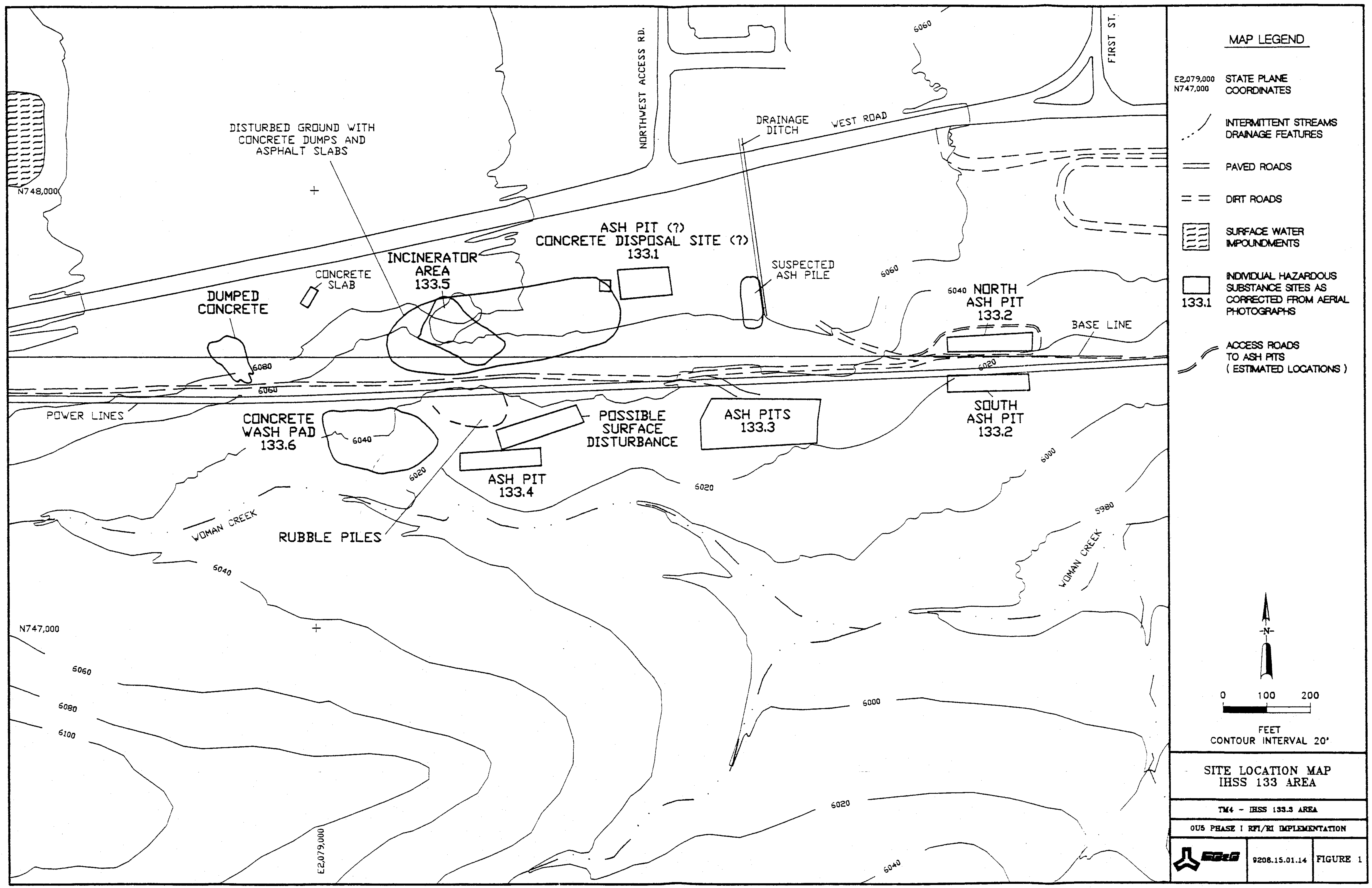
									BOTTLE CODES		R	R	R	R	R	R	R	R	R	R	R	R
											A	B	C	D	F	A	B	C	D	F	G	H
									PRESERVATIVE							*	*	*	*	*		
DATE/TIME	SAMPLE NUMBER	LOCATION	CONTAINER TYPE	NUMBER OF CONTAINERS	MEDIA SOIL(S) WATER (W)	FILTERED=F POT DISS=P	TURN AROUND RUSH =R	OUT OF SPEC REPORTS	HCl	HNO3	GROSS ALPHA / BETA	Pu 239/240 AM241	U 233/234,235,238	Sr89/90 Cs137 (1)	Th230/232,CM244,NP237	DISS GROSS ALPHA/BETA	DISS Pu 239/240 Am 241	DISS U233/234,235,238	DISS Sr 89/90 Cs 137 (1)	DISS Th230/2 CM244 NP237	TRITIUM (H3)	RAD SCREEN

RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME

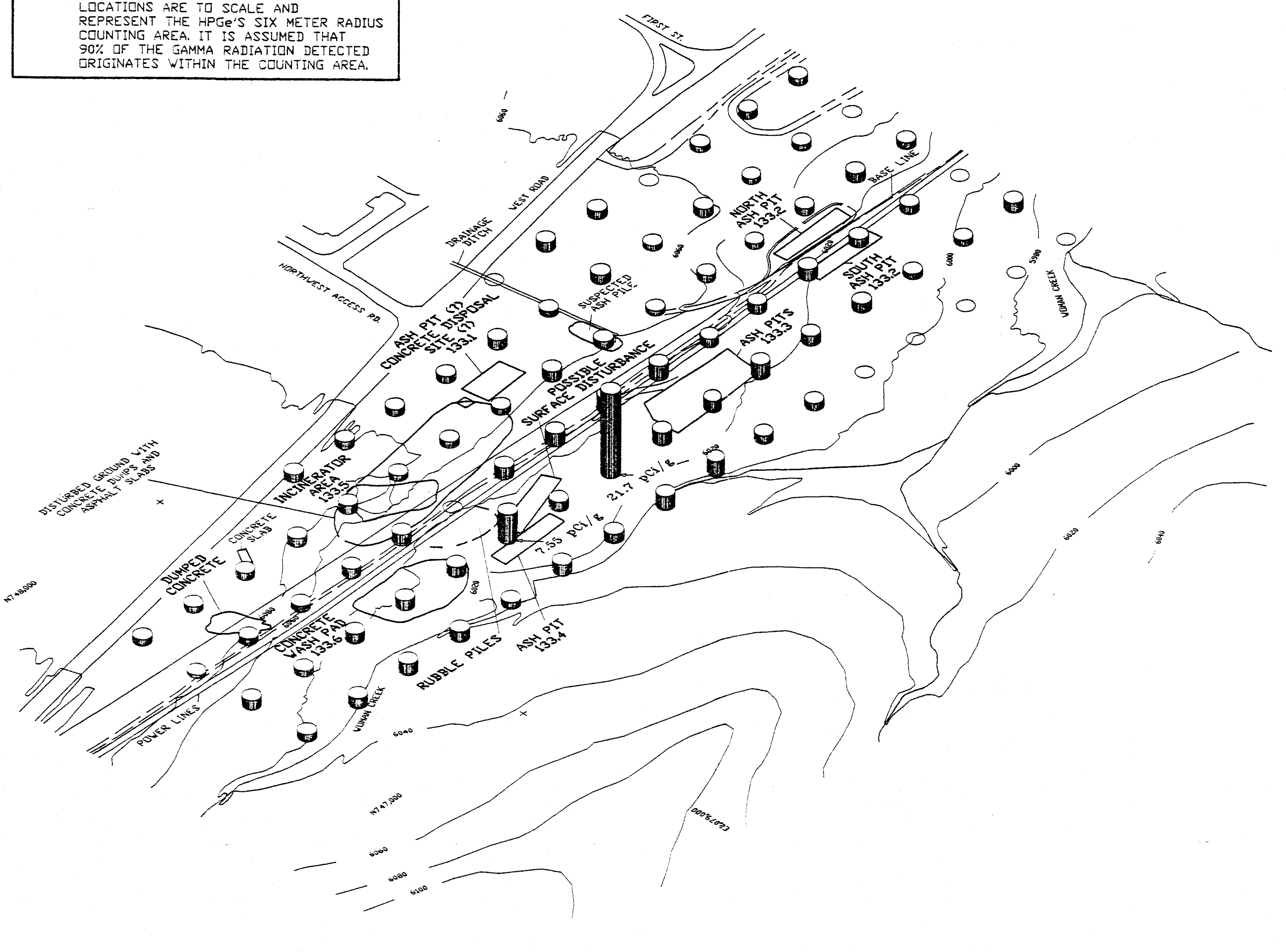
LABORATORY USE ONLY	Y	N
PCKG REC'D/CUSTODY SEALS INTACT		
SAMPLE LABELS/COCs AGREE		
TEMPERATURE WITHIN SPECIFICATION ______ C		
CORRECTED COPY ATTACHED		
PROBLEMS OR DISCREPANCIES		

REMARKS * INDICATES FILTERED SAMPLE
(1) • Cs 134 WHEN BY GAMMA

SHIPMENT METHOD


MAP LEGEND
E2,079,000 N747,000 STATE PLANE COORDINATES
INTERMITTENT STREAMS DRAINAGE FEATURES
PAVED ROADS
DIRT ROADS
SURFACE WATER IMPOUNDMENTS
INDIVIDUAL HAZARDOUS SUBSTANCE SITES AS CORRECTED FROM AERIAL PHOTOGRAPHS
133.1
ACCESS ROADS TO ASH PITS (ESTIMATED LOCATIONS)
N
0 100 200
FEET
CONTOUR INTERVAL 20'
DISTURBED GROUND WITH CONCRETE DUMPS AND ASPHALT SLABS
NORTHWEST ACCESS RD.
DRAINAGE DITCH
WEST ROAD
FIRST ST.
N748,000
ASH PIT (?) CONCRETE DISPOSAL SITE (?) 133.1
SUSPECTED ASH PILE
INCINERATOR AREA 133.5
CONCRETE SLAB
DUMPED CONCRETE
NORTH ASH PIT 133.2
BASE LINE
SOUTH ASH PIT 133.2
POWER LINES
CONCRETE WASH PAD 133.6
POSSIBLE SURFACE DISTURBANCE
ASH PITS 133.3
ASH PIT 133.4
RUBBLE PILES
WOMAN CREEK
WOMAN CREEK
N747,000
E2,079,000
6060
6060
6040
6080
6060
6020
6040
6020
6020
6000
5980
6040
6060
6080
6100
6000
6020
6040
SITE LOCATION MAP IHSS 133 AREA
TM4 - IHSS 133.3 AREA
OU5 PHASE I RFI/RI IMPLEMENTATION
EG&G
9208.15.01.14
FIGURE 1
05TM4-1.DWG

NOTE : THE DIAMETER OF THE CIRCLES USED TO ILLUSTRATE THE SURVEY LOCATIONS ARE TO SCALE AND REPRESENT THE HPGe'S SIX METER RADIUS COUNTING AREA. IT IS ASSUMED THAT 90% OF THE GAMMA RADIATION DETECTED ORIGINATES WITHIN THE COUNTING AREA.



MAP LEGEND

E2,079,000 N747,000	STATE PLANE COORDINATES
	INTERMITTENT STREAMS DRAINAGE FEATURES
	PAVED ROADS
	DIRT ROADS
133.1	INDIVIDUAL HAZARDOUS SUBSTANCE SITES AS CORRECTED FROM AERIAL PHOTOGRAPHS
	OU5 BOUNDARY
	ACCESS ROADS TO ASH PITS (ESTIMATED LOCATIONS)
	0 - 1 pCi/g U238
	1 - 5 pCi/g U238
	> 5 pCi/g U238

N

0 100 200

FEET

CONTOUR INTERVAL 20'

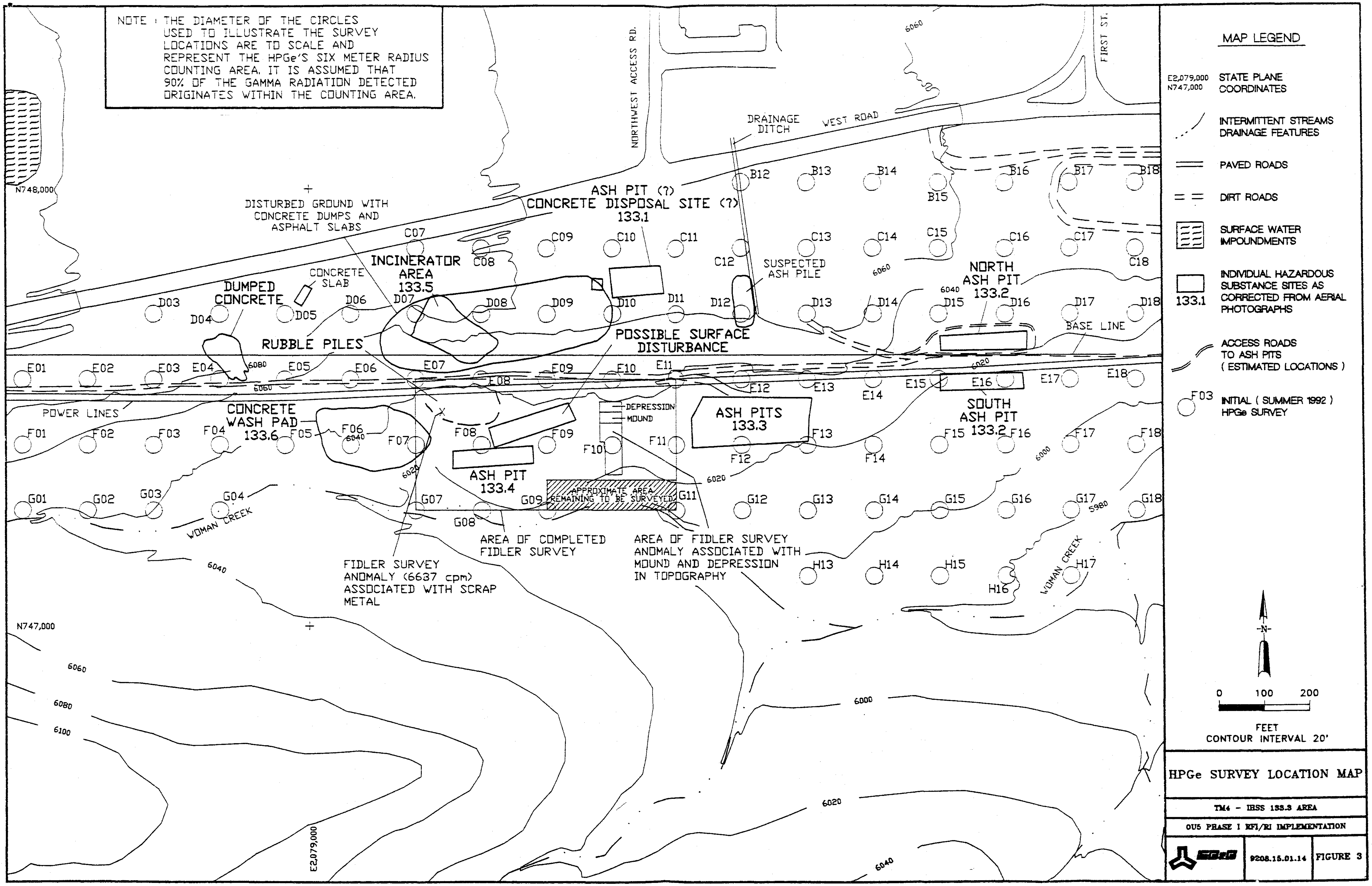
HPGe GAMMA RADIATION SURVEY – U[238]

TM4 - IHSS 133.3 AREA

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G 9208.15.01.14 FIGURE 2

OSTM4-2.DWG



HPGe SURVEY LOCATION MAP

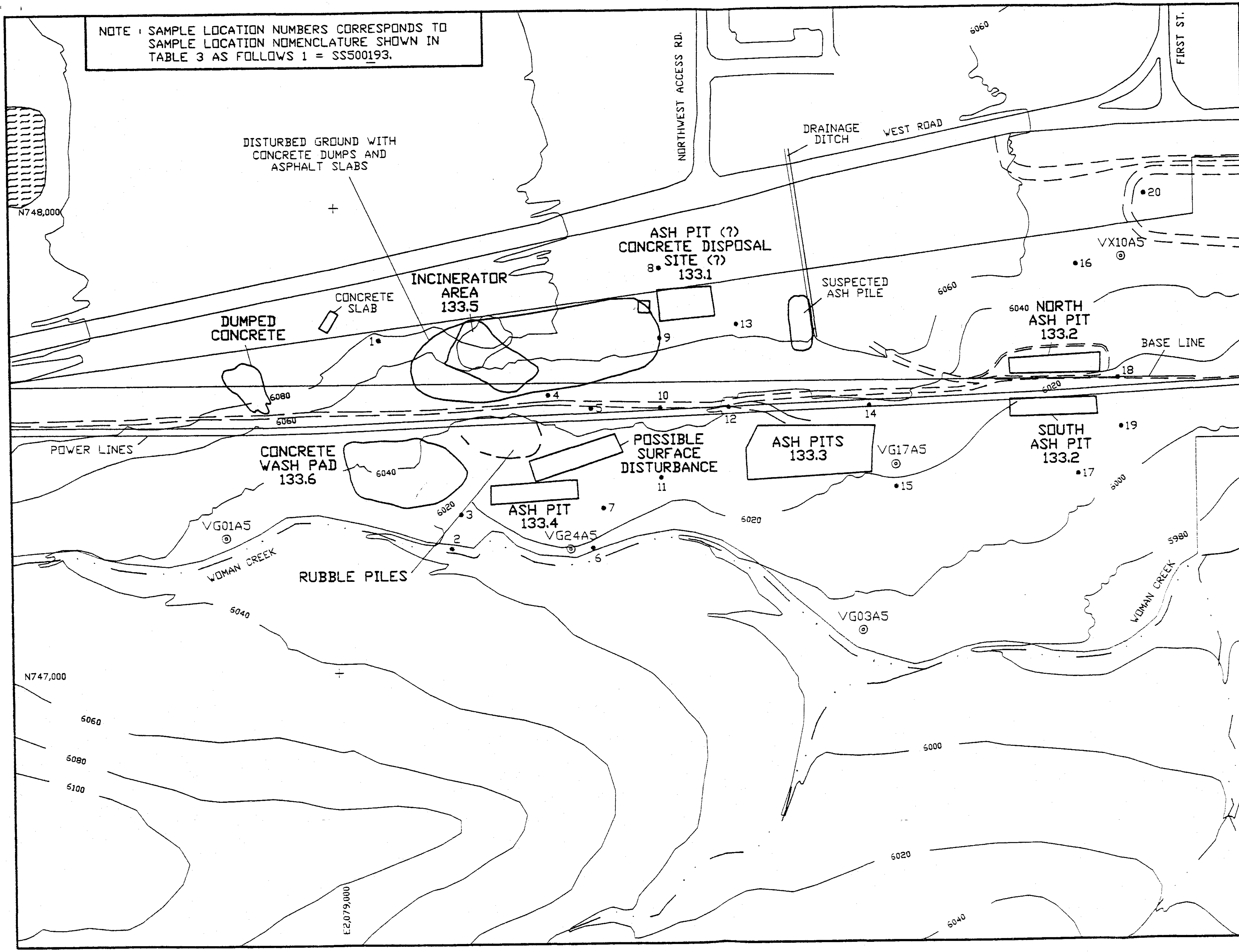
TM4 - IHSS 133.3 AREA

OU5 PHASE I RFI/RI IMPLEMENTATION

9208.15.01.14 FIGURE 3

D5TM4-3.DWG

NOTE : SAMPLE LOCATION NUMBERS CORRESPONDS TO SAMPLE LOCATION NOMENCLATURE SHOWN IN TABLE 3 AS FOLLOWS 1 = SS500193.



MAP LEGEND

E2,079,000 N747,000	STATE PLANE COORDINATES
	INTERMITTENT STREAMS DRAINAGE FEATURES
	PAVED ROADS
	DIRT ROADS
	SURFACE WATER IMPOUNDMENTS
133.1	INDIVIDUAL HAZARDOUS SUBSTANCE SITES AS CORRECTED FROM AERIAL PHOTOGRAPHS
	OU5 BOUNDARY
	ACCESS ROADS TO ASH PITS (ESTIMATED LOCATIONS)
•1	PROPOSED SURFACE SOIL SAMPLE LOCATION
VG24A5	SOIL SAMPLES COLLECTED FOR OTHER ENVIRONMENTAL STUDIES

-N-

0 100 200

FEET

CONTOUR INTERVAL 20'

SURFACE SOIL SAMPLE LOCATION MAP

TM4 - IHSS 133.3 AREA

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G | 9208.15.01.14 | FIGURE 6

OSTM4-6.DWG