NOTICE

All drawings located at the end of the document.

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Uhland, Jennifer		
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August 7, 1997

97-RF-04293

Norma Castaneda
ES&H Program Assessment
DOE, RFFO

TRANSMITTAL OF THE DRAFT POST CORRECTIVE ACTION DECISION/RECORD OF DECISION INVESTIGATION REPORT FOR THE 881 HILLSIDE AREA IHSS 119.1 - AKS-035-97

Please find enclosed the Draft Post Corrective Action Decision/Record of Decision Investigation Report for the 881 Hillside Area IHSS 119.1. Comments on the Draft Report are requested by August 12, 1997.

Two copies of the draft report have been hand delivered for distribution and review by August 12. Please note that to expedite the planning process, DOE's review is concurrent with Kaiser-Hill's.

If you have any questions regarding this transmittal, please contact me at (303) 966-9886.

A. K. Sieben
Waste & Remediation Operations

bag

Orig. and 1 cc - N. Castaneda

Enclosure:
As Stated

AUG 1997
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Courier Address Rocky Flats Environmental Technology Site, State Hwy 93 and Cactus, Rocky Flats, CO 80027 • 303.966.7000
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ER/WM&I DDT

August 12, 1997

01117RF97

Source/Driver: (Name & Number from ISP, IAG milestone, Mgmt. Action, Corres. Control, etc.)

Closure #: (Outgoing Correspondence Control #, if applicable)

Due Date

Wayne Sproles
Originator Name

G. D. DiGregorio
QA Approval

A. L. Primrose
Contractor Manager(s)

Ann K. Sieben
Kaiser-Hill Program Manager(s)

T. G. Hedahl
Kaiser-Hill Director

Document Subject:

Transmittal of Draft Post Corrective Action Decision/Record of Decision Investigation Report for the 881 Hillside Area IHSS 119.1 - ALP-007-97

KH-00003NS1A

August 7, 1997

Discussion and/or Comments:

RMRS is pleased to provide 2 copies of the subject report for Kaiser-Hill review and comment and 2 copies for Kaiser-Hill transmittal to DOE. The Draft Post Corrective Action Decision/Record of Decision Investigation Report was prepared to document findings from the recent sampling at 881 Hillside Area IHSS 119.1. Comments are requested by August 12, 1997.

If you have any questions, please contact Wayne Sproles at extension 5790.

Attachments:
As Stated (4)

WRS:la

cc:
A. C. Crawford
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A. L. Primrose
W. R. Sproles
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RMRS Records (1)

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DRAFT POST CORRECTIVE ACTION DECISION/ RECORD OF DECISION INVESTIGATION REPORT FOR THE 881 HILLSIDE AREA IHSS 119.1

Rocky Mountain Remediation Services, L.L.C.

August 1997
Revision A

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DRAFT
POST CORRECTIVE ACTION DECISION/RECORD OF DECISION INVESTIGATION REPORT FOR THE 881 HILLSIDE AREA IHSS 119.1

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LIST OF ACRONYMS

ALF	Action Levels & Standards Framework for Surface Water, Ground Water and Soil
ARAR	Applicable or Relevant and Appropriate Requirement
CAD/ROD	Corrective Action Decision /Record of Decision
CCR	Colorado Code of Regulations
CDPHE	Colorado Department of Public Health and The Environment
CFR	Code of Federal Regulations
COC	Contaminant of Concern
DNAPL	Dense Non-Aqueous Phase Liquid
DOE	Department of Energy
EPA	Environmental Protection Agency
FID	Flame Ionization Detector
FIDLER	Field Instrument for the Detection of Low Energy Radiation
IHSS	Individual Hazardous Substance Site
mg/Kg	Milligrams Per Kilogram
pCi/g	Pico Curies Per Gram
ppm	Parts per Million
QA	Quality Assurance
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RAP	Remedial Action Plan
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RFI/RI	RCRA Facility Investigation/Remedial Investigation
SAP	Sampling Analysis Plan
SID	South Interceptor Ditch
VOC	Volatile Organic Compound
yd^3	cubic yard

1.0 INTRODUCTION

The Corrective Action Decision/Record of Decision (CAD/ROD) Declaration for Operable Unit 1 (OU-1), 881 Hillside Area, Rocky Flats Environmental Technology Site (RFETS) (DOE, 1997) presented the selected remedy for addressing contamination in subsurface soil at Individual Hazardous Substance Site (IHSS) 119.1 (Figure 1-1). Past releases contributed to the degradation of groundwater quality in the immediate vicinity of the IHSS and contaminated subsurface soils were assumed to be present and localized in the southwest portion of the IHSS acting as a source for groundwater contamination (DOE, 1994). As presented in the CAD/ROD, the selected remedial action included excavation and treatment of volatile organic compound (VOC)-contaminated soil by low temperature thermal desorption (DOE, 1997). The contaminants of concern (COCs) identified for treatment were as follows:

- Carbon tetrachloride,
- 1,1-Dichloroethene,
- Tetrachloroethene,
- 1,1,1-Trichloroethane, and
- Trichloroethene.

The CAD/ROD also required subsurface soil sampling downgradient of the IHSS to verify that a contaminant source in the downgradient vicinity did not exist. To meet this requirement, and investigation was conducted in May of 1997 to verify that a downgradient source did not exist. In addition to the downgradient sampling, soil samples were collected in the areas tentatively identified in the CAD/ROD for excavation at IHSS 119.1 to determine the health and safety requirements and radiological controls necessary during the remedial action. The scope of these sampling activities was described in the *Final Sampling and Analysis Plan for the Downgradient Investigation of IHSS 119.1* (RMRS, 1997a) and the *Final Sampling and Analysis Plan for Implementation Samples for the IHSS 119.1 Source Removal Project* (RMRS, 1997b) both of which were appended to the *Sampling and Analysis Plan, Identification and Delineation of Contaminant Source Area for Excavation Purposes, Individual Hazardous Substance Site 119.1, Operable Unit 1* (RMRS, 1995).

This report summarizes the findings of these investigations and, as a result of these findings, recommends the selected remedy presented in the CAD/ROD (DOE, 1997) be amended. Sections 2.0 and 3.0 present a summary of the field activities, analytical results, and conclusions for the downgradient and implementation investigations, respectively. The validation results will be evaluated for data usability as part of the quality control for the project and submitted as an addendum to this report. Section 4.0 discusses the impact the results of these investigations have on the CAD/ROD and the remedial action objectives (RAOs) contained therein as well as provides technical basis to amend the selected remedy.

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2.0 DOWNGRADIENT INVESTIGATION

IHSS 119.1 is located on a south facing hillside where unconsolidated surficial materials overlie weathered claystone bedrock. Groundwater occurs in the unconsolidated surficial materials primarily in disconnected northwest-southeast trending paleochannels which cut into the bedrock surface. Previous investigations located a paleochannel within IHSS 119.1 that continues downgradient where it is intercepted by the French Drain. This paleochannel is approximately 100 feet wide and five feet deep, and directs the groundwater flow to the south. Wells 32591 and 0487 are located within this paleochannel. (RMRS, 1997a)

In compliance with the CAD/ROD (DOE, 1997), additional sampling was performed downgradient of IHSS 119.1 to verify that the subsurface paleochannel does not contain VOCs at levels that could significantly impact surface water quality. The sampling and analysis approach was described in *Final Sampling and Analysis Plan for the Downgradient Investigation of IHSS 119.1* (RMRS, 1997a). The area investigated is located between the southern boundary of IHSS 119.1 and well 0487 (Figure 2-1). As summarized in the downgradient SAP, groundwater wells 0487 and 32591, located within the paleochannel downgradient of IHSS 119.1, contain elevated concentrations of VOCs above Tier II groundwater action levels. The VOCs detected are primarily carbon tetrachloride, tetrachloroethene, and trichloroethene (DOE 1994). It was assumed that if these contaminants were present as free phase liquids, residual amounts will tend to pool or collect at or near the contact with the underlying claystone bedrock. Therefore, to determine whether dense non-aqueous phase liquid (DNAPL) was present, geoprobe borings were located within the paleochannel between the IHSS 119.1 southern boundary and well 0487.

2.1 Summary of Field Activities

Eleven geoprobe boreholes were located approximately 20 feet apart along the trend of the paleochannel (Figure 2-1) to investigate the deepest portion of the paleochannel. Of the 11 locations identified in the downgradient SAP, two (12897 and 13097) required minor offsets (i.e., 1 foot) due to refusal. All geoprobe boreholes were advanced to a minimum depth of two feet into bedrock. Borehole logs are presented in Appendix A. The borehole logs detail the increments of core recovered and sampled, sample descriptions, soil types, and lithology of the core.

Subsurface soil samples were collected in the colluvium immediately above bedrock in each borehole location with one exception. A sample for borehole 13097 was not collected at the bedrock interface because of geoprobe advancement problems and poor core recovery. Samples were also collected when a positive detection (i.e., greater than 1 ppm) was observed on the Photoionization Detector/Flame Ionization Detector (PID/FID) during field screening of the core. Table 2-1 summarizes the borehole identification numbers, sample numbers, the sampled interval, depth to bedrock, and rationale for sample collection at the interval indicated.

2.2 Analytical Results

The subsurface soil samples were analyzed for VOCs using method SW846/SW8260A. The analyte suite associated with this method includes 38 VOCs (Appendix B) and any tentatively identified compounds (TICs) recognized in a library search performed by the instrument. None of the IHSS 119.1 COCs were detected above their corresponding detection limit (0.62 mg/Kg) (Table 2-2). Low levels of acetone, carbon disulfide, and 2-butanone were detected in several samples. These compounds were all estimated below the detection limit (i.e., "J" qualified) and

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acetone and carbon disulfide were inconsistently detected in the method blanks associated with the analysis runs. These compounds are considered common laboratory contaminants and are not considered to be indicative of contamination in the downgradient samples collected. Chloromethane and acetone were also detected in the rinsate sample associated with these samples at concentrations of 7.2 and 5.7 µg/L, respectively. The analytical results are presented in Appendix C. The quality assurance/quality control for the project will be further evaluated with the validated data for usability with respect to precision, accuracy, and representativeness, comparability, and completeness and submitted as an addendum to this report.

2.3 Conclusions

The results from the downgradient investigation indicate that the subsurface paleochannel downgradient of IHSS 119.1 does not contain a DNAPL source. The requirements of the CAD/ROD (DOE, 1997) have been fulfilled through implementation of this sampling program.

Table 2-1. Sample Summary - Downgradient Investigation

LOCATION CODE	SAMPLE NUMBER	SAMPLED INTERVAL (FEET)	DEPTH TO BEDROCK (FEET)	RATIONALE FOR SAMPLE COLLECTION
12797	BH10062RM	9.25 - 9.5	9.5	Bedrock contact
12897	BH10059RM	4.1 - 4.5	12.3	1.5 ppm PID/FID reading
12897	BH10060RM	12 - 12.3	12.3	Bedrock contact
12897	BH10061RM	13 - 13.4	12.3	6 ppm PID/FID reading
12997	BH10063RM	7.85 - 8.1	8	Bedrock contact
13097	BH10064RM	11 - 11.4	12.5	1 ppm PID/FID reading
13197	BH10071RM	11.5-12	12	Bedrock contact
13197	BH10072RM	NA	12	Rinsate
13297	BH10066RM	11.2-11.6	11.6	Bedrock contact
13397	BH10065RM	15.3-15.8	15.8	Bedrock contact
13497	BH10070RM	18-18.3	18	Bedrock contact
13597	BH10069RM	15.0-15.8	15	Bedrock contact
13597	BH10069RM DUP	15.8-16.5	15	Duplicate/Bedrock contact
13697	BH10067RM	15.5-15.8	15.8	Bedrock contact
13797	BH10068RM	13.0-13.4	13.2	Bedrock contact

Table 2-2. Analytical Data Summary - Downgradient Investigation.

COC	DOWNGRADIENT INVESTIGATION - FOD[1]	DOWNGRADIENT INVESTIGATION RESULTS (MG/KG)
Carbon Tetrachloride	0/13	0.62 U
1,1-Dichloroethene	0/13	0.62 U
Tetrachloroethene	0/13	0.62 U
1,1,1-Trichloroethane	0/13	0.62 U
Trichloroethene	0/13	0.62 U

[1]FOD = Frequency of Detection represents the number of detections/number of samples. Number of samples does not include duplicates.
U = COC was not detected at the level indicated.

3.0 IMPLEMENTATION SAMPLING

The *Final Sampling and Analysis Plan for Implementation Samples for the IHSS 119.1 Source Removal Project* (implementation SAP) (RMRS, 1997b) described the technical basis and approach for placing the geoprobe boreholes within the two areas assumed to be contaminated based per the CAD/ROD (DOE, 1997). A statistical approach was used to determine the grid spacing for the sampling based upon the methods developed by R.O. Gilbert for locating hotspots (RMRS, 1997b). The purpose for the sampling was to assess the need for a radiological work permit for the remedial action, complete the health and safety plan, and provide data for the Air Pollution Emission Notice (APEN). While the 1996 field investigation determined the location of the source areas within IHSS 119.1, no radiological samples were collected to determine radiological conditions at depth (RMRS, 1996). Headspace analysis of subsurface soil samples were conducted to delineate the excavation area; however, quantitative (i.e., compound specific) analyses for VOCs were required for the health and safety plan and the APEN. For Remedial Design/Remedial Action (RD/RA) purposes, the results from these borehole samples were intended to more accurately delineate the target excavation area for the RA.

3.1 Summary of Field Activities

In accordance with the Implementation Samples SAP, three geoprobe borings were located within the highest concentration area for each of the two source areas delineated by the headspace survey and identified in the CAD/ROD (Figure 3-1). No significant VOC contamination (i.e., only one estimated value for tetrachloroethene) was observed in any of these borings. In response, four additional geoprobe borings were placed at those locations believed to be biased towards finding detectable contamination. For all borings, radiological samples were collected to represent the 0 to 2.5 foot and 2.5 to 5 foot intervals. Radiological samples from the initial six geoprobe locations were analyzed. Because activities were below Tier II action levels, the radiological samples collected from the final four boreholes were not analyzed. Samples were collected for VOC analyses by method SW846/8260A at 5 foot intervals, the bedrock contact, and anytime a positive detection (i.e., greater than 1 ppm) on the PID/FID was observed during field screening of the core. The borings were advanced to a minimum depth of approximately 2 feet into bedrock. Borehole logs are presented in Appendix A.

The boreholes were drilled without incident with the exception of 12197. Refusal was encountered on the first two drilling attempts; however, the third attempt was successful. Table 3-1 summarizes the borehole identification numbers, the sampled interval, depth to bedrock, and rationale for sample collection at the interval indicated for the VOC samples.

3.2 Analytical Results

As discussed in Section 3.1, the subsurface soil samples were analyzed for VOCs using method SW846/SW8260A. As summarized on Table 3-2, 1,1-dichloroethene, 1,1,1-trichloroethane, and trichloroethene were detected in only 2 of 38 samples. The COCs were observed in borehole 13997 in samples from the 15 to 15.3 foot interval and the 15.7 to 16.3 foot interval. The concentrations detected were all estimated values below the detection limit (i.e., "J" qualified). Tetrachloroethene was also detected in the samples from the same intervals in borehole 13997. The 0.66 mg/Kg concentration was the only concentration above the 0.62 mg/Kg detection limit and was observed in the sample from the 15.7 to 16.3 foot interval. Tetrachloroethene was also

detected in borehole 12397 in the sample from the 4.4 to 4.8 foot interval; however, the concentration observed was estimated below the practical quantitation limit of 0.62 mg/Kg.

Low levels of acetone, methylene chloride, 2-hexanone, carbon disulfide, and 2-butanone were inconsistently detected in several samples. These compounds were all estimated below the practical quantitation limit (i.e., "J" qualified) and acetone and carbon disulfide were inconsistently detected in the method blanks associated with the analysis runs. These compounds are considered common laboratory contaminants and are not considered to be indicative of contamination. Chloromethane was also detected in the rinsate sample associated with these samples at concentrations of 6.9 µg/L. A summary of the analytical results for the COCs is provided in Table 3-2 along with the Rocky Flats Cleanup Agreement (RFCA) Tier I subsurface soil action levels (DOE, 1996). The analytical results for the VOC analyses are also presented in Appendix D. The quality assurance/quality control will be further evaluated with the validated data for usability with respect to precision, accuracy, and representativeness, comparability, and completeness and submitted as an addendum to this report.

The maximum observed activity for the radiological samples which were analyzed is presented in Table 3-3 along with RFCA Tier II surface soil action levels for radionuclides (DOE, 1996). As noted above, the radiological samples were collected from all geoprobe borings; however, the results presented represent the maximum concentration observed in the first six borings.

3.3 Conclusions

Hypotheses regarding the DNAPL release and migration in the subsurface (i.e., extent of vertical migration, DNAPL pooling or penetrating bedrock) at IHSS 119.1 have been formulated (DOE, 1994; DOE, 1995). The hypotheses assume the presence of an immobile and/or mobile DNAPL source within IHSS 119.1. As described in the Phase III RFI/RI (DOE, 1994) and elaborated on in the OU 1 CMS/FS (DOE, 1995), when DNAPLs are released to soils, they migrate vertically through the vadose zone as a gravity-driven wetting front. The rate of migration vertical migration is partially dependent on the rate of the release. The small release hypothesis indicates that the mass would not be sufficient enough to sustain a wetting front and advance all the way to the water table or bedrock. Under this hypothesis, immobile DNAPL is expected to accumulate in the vadose zone and colluvial material in the pore spaces of the soil. A larger release hypothesis indicates that the DNAPL could reach the water table as a wetting front and advance through the water table to the bedrock surface. Under this hypothesis, mobile DNAPL would be encountered at the bedrock surface or in fractures encountered in bedrock (DOE, 1994; DOE, 1995). A third hypothesis conceptualizes the mobile DNAPL pooled on bedrock slump blocks routinely observed in IHSS 119.1 and the hillside area. This pooling would preclude deeper migration of the DNAPL to bedrock.

The lack of VOC contamination observed in the implementation samples indicate that a source does not exist under any of the hypothetical circumstances described above. Samples of the colluvium and bedrock do not indicate a residual VOC contamination or DNAPL source. Additionally, reworked bedrock material that is indicative of slumps on the hillside was encountered in several of the boreholes (Appendix A). VOC contamination was not observed at these sampled intervals.

Within the boundary of investigation, no subsurface soil contamination was detected equal to or above the RFCA Tier I subsurface soil action levels (DOE, 1996) at IHSS 119.1. The remedy selected in the CAD/ROD (DOE, 1997) should be amended to reflect the findings of this investigation.

Table 3-1. Sample Summary - Implementation Sampling

LOCATION CODE	SAMPLE NUMBER	SAMPLED INTERVAL (FEET)	DEPTH TO BEDROCK (FEET)	RATIONALE FOR SAMPLE COLLECTION
12197	BH10028RM	4.3-4.6	5.6	Interval sample
12197	BH10029RM	5.0-5.6	5.6	Bedrock contact
12297	BH10032RM	4.25-4.5	7	Interval sample
12297	BH10033RM	6.75-7.0	7	Bedrock contact
12297	BH10034RM	10.25-10.8	7	Interval sample
12397	BH10037RM	4.4-4.8	9.7	Interval sample
12397	BH10038RM	9.2-9.7	9.7	Bedrock contact
12397	BH10039RM	13.0-13.4	9.7	Interval sample
12497	BH10042RM	4.75-5.0	7	Interval sample
12497	BH10043RM	6.5-6.8	7	Bedrock contact
12497	BH10044RM	8.9-9.2	7	Interval sample
12597	BH10045RM	NA	NA	Rinsate
12597	BH10049RM	4.7-5.0	10.3	Interval sample
12597	BH10050RM	8.7-9.4	10.3	Interval sample
12597	BH10051RM	10.0-10.3	10.3	5 ppm PID/FID reading/ Bedrock contact
12597	BH10051RM DUP	10.3-10.6	10.3	Duplicate
12597	BH10052RM	15.7-16.1	10.3	Interval sample
12697	BH10055RM	4.7-5.0	12.1	Interval sample
12697	BH10056RM	9.4-9.6	12.1	Interval sample
12697	BH10057RM	11.6-11.9	12.1	Bedrock contact
12697	BH10058RM	14.7-15.0	12.1	3 ppm PID/FID reading
14097	BH10075RM	4.6-4.8	16.3	Interval sample
14097	BH10076RM	8.0-8.3	16.3	Interval sample
14097	BH10077RM	14.7-15.0	16.3	Interval sample
14097	BH10078RM	16.0 - 16.4	16.3	Bedrock contact
13997	BH10080RM	0 - 0.2 /1.7 - 1.8	15.1	35 ppm PID/FID reading
13997	BH10082RM	4.7-5.0	15.1	Interval sample
13997	BH10083RM	9.6-9.9	15.1	Interval sample
13997	BH10084RM	13.9 - 14.3	15.1	Interval sample
13997	BH10085RM	15-15.3	15.1	100 ppm PID/FID reading/ Bedrock contact
13997	BH10086RM	15.7-16.3	15.1	400 ppm PID/FID reading
13997	BH10087RM	21.2 - 21.5	15.1	15 ppm PID/16 ppm FID reading
13897	BH10090RM	4.6 - 4.9	9	1 ppm PID/FID reading
13897	BH10091RM	9.7 - 10.0	9	Bedrock contact
13897	BH10092RM	13.3 - 13.6	9	Interval sample
13897	BH10093RM	18.7 - 19.0	9	Interval sample
14197	BH10096RM	4.7 -5.0	10.9	Interval sample
14197	BH10096RM DUP	4.4 - 4.7	10.9	Duplicate
14197	BH10097RM			Rinsate
14197	BH10098RM	9.4-9.8	10.9	Interval sample
14197	BH10099RM	10.6 - 11.0	10.9	Bedrock contact
14197	BH10100RM	13.5 - 13.8	10.9	Interval Sample

Table 3-2. Analytical Data Summary - Implementation Sampling

COC	IHSS 119.1 BOREHOLE SAMPLING - FOD[1]	IHSS 119.1 BOREHOLE SAMPLING RESULTS (MG/KG)	RFCA TIER I ACTION LEVELS (MG/KG)
Carbon Tetrachloride	0/38	0.62 U	11.0
1,1-Dichloroethene	2/38	0.17J - 0.23J[2]	11.9
Tetrachloroethene	3/38	0.16J - 0.66[2]	11.5
1,1,1-Trichloroethane	2/38	0.16J - 0.28J[2]	378
Trichloroethene	2/38	0.34J - 0.55J[2]	9.27

[1]FOD = Frequency of Detection represents the number of detections/number of samples. Number of samples does not include duplicates.
[2] Range of detected values.
U = COC was not detected at the level indicated.
J = estimated concentration at the level indicated. The concentration represents a value below the detection limit.

Table 3-3. Radiological Sample Results

DETECTED RADIONUCLIDE	MAXIMUM IHSS 119.1 SAMPLE RESULT (PCI/G)	RFCA TIER II ACTION LEVEL (PCI/G)[1]
Uranium-238	0.092	3.15
Radium-226	0.018	0.0247
Uranium-235	0.006	0.628
Cesium-137	0.042	0.0797
Americium-241	0.015	23.6

[1]Represent RFCA Tier II Surface Soil Action Levels for Open Space Soil/Sediment

4.0 CONCLUSIONS

Based on the findings of the downgradient and implementation investigations, the following conclusions are made.

- As stated in Section 2.3, the results of the downgradient investigation demonstrate the subsurface paleochannel does not contain a DNAPL source. Thus this component of the CAD/ROD has been fulfilled.

- The results of the implementation investigation indicate that the selected remedy in the CAD/ROD (DOE, 1997) should be re-evaluated because the data indicate that a residual VOC source in subsurface soil is not present at the IHSS.

Given that the results of these investigations demonstrate there is not a source or measurable contamination in the downgradient vicinity of IHSS 119.1 or within the IHSS itself, the following section discusses the conclusions in relation to the remedial action objectives (RAOs) in the CAD/ROD (DOE, 1997) with respect to the implementation sampling results.

As presented in the Corrective Measures Study/Feasibility Study for OU 1 (DOE, 1995) and summarized in the CAD/ROD (DOE, 1997), the RAOs for IHSS 119.1 are as follows:

1. Prevent the inhalation of, ingestion of, and/or dermal contact with VOCs and inorganic contaminants in OU-1 groundwater that would result in a total excess cancer risk greater than 10^{-4} to 10^{-6} for carcinogens, and/or a hazard index greater than or equal to one for noncarcinogens.

2. Prevent migration of contaminants from subsurface soils to groundwater that would result in groundwater contamination in excess of potential groundwater applicable or relevant and appropriate requirements (ARARs) for OU-1 contaminants

3. Prevent migration of contaminants in OU-1 groundwater from adversely impacting surface water quality in Woman Creek.

Achievement of each of these RAOs is discussed below.

The CAD/ROD addressed achievement of the first RAO through the use of institutional controls (DOE, 1997). Specifically, the CAD/ROD states:

> "Institutional controls will be maintained throughout the OU 1 area in a manner consistent with RFCA, Rocky Flats Vision, and the ALF. These documents recognize the reasonably foreseeable future land use for the OU 1 area is restricted open space. The institutional controls will ensure that the restricted open space land use is maintained for the OU 1 area and that domestic use of groundwater is prevented. If the reasonably foreseeable future land use for OU 1 area changes when final sitewide land use decisions are made, this remedy will be reexamined to ensure protectiveness of human health and the environment. The specific mechanisms (for example, deed restrictions) to ensure the implementation and continuity of the necessary institutional controls have not been included in this CAD/ROD. Currently, these mechanisms are envisioned to be placed in the Final Sitewide CAD/ROD or in this CAD/ROD during one of the five-year reviews of this document. However, should the Final CAD/ROD not occur or not include these institutional control mechanisms, this OU 1 CAD/ROD will be revised to include them, if it does not already include them as a result of a five-year review. The institutional controls can also be

removed at one of the above times, if it is deemed appropriate to do so by the parties."(DOE, 1997)

The findings of this investigation do not affect achievement of this RAO. In other words, institutional controls throughout the OU 1 area will be maintained regardless of the remedy selected.

The second RAO has been achieved without the removal action promulgated in the CAD/ROD (DOE, 1997) as demonstrated by the results of the implementation sampling detailed in Section 3.0 of this report. The selected remedy was based on estimates of the extent of a VOC contaminant source beneath IHSS 119.1 which was assumed from the results of a qualitative (i.e., not compound specific) measurement technique (i.e., headspace analysis using a field instrument) rather than quantitative soil concentrations. As shown by the results of the implementation samples, a significant source is not present in the areas previously identified for cleanup. As a result, the RAO addressing the prevention of contamination to groundwater from subsurface soil contamination has been achieved without conducting the soil excavation component of the selected remedy. It is assumed that this RAO has apparently been achieved by natural dispersion and degradation.

The third RAO targets prevention of groundwater influence to surface water. Specifically, as stated in the CAD/ROD, this RAO was intended to be met by the following:

> "Groundwater will be extracted from the excavation and will be transferred to the existing Building 891 ultraviolet/hydrogen peroxide and ion exchange water treatment system for final treatment and discharge. After all contaminated subsurface soil has been excavated and all contaminated groundwater has been extracted from the excavation, the French Drain will system will be decommissioned and its use will be discontinued. The final details of the groundwater extraction and the decommissioning of the French Drain will be presented in the Remedial Design for OU-1." (DOE, 1997)

Additionally,

> "DOE anticipates that groundwater monitoring will be performed at IHSS 119.1, consistent with the Integrated Water Management Plan, after the remedial action is complete. The details of this groundwater monitoring will be presented in the RD." (DOE, 1997)

The implementation sample investigation results indicate that there is not a subsurface soil contaminant source capable of continuing to contaminate groundwater at IHSS 119.1 as previously assumed. Excavation should not be performed based on the analytical data supporting this conclusion. As a result, the groundwater extraction component of the selected remedy can not be performed and another means of addressing this RAO needs to be proposed. However, the groundwater monitoring component of the selected remedy does not require modification. Concurrence with respect to these conclusion has been received from the EPA (see Appendix E).

5.0 RECOMMENDATIONS

The information presented in this report demonstrates the paleochannel downgradient of IHSS 119.1 is not a DNAPL source or contaminated with VOCs. Also, the subsurface soils in the investigated area of IHSS 119.1 are not contaminated above the RFCA Tier I Subsurface Soil Action Levels (DOE, 1996) as assumed in the CAD/ROD. As a result, compliance with RFCA is achieved without conducting the soil excavation and treatment as specified in the CAD/ROD.

Section 117(c) and (d) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) contains provisions for addressing and documenting changes to a remedy that occurs after a ROD is signed. Reconsideration and selection of a different remedy represents a fundamental change as discussed in *Guidance on Preparing Superfund Decision Documents*, Interim Final, July 1989 (EPA, 1989). In the event that new information results in the reconsideration of the remedy selected in the ROD, a ROD amendment is required. The public participation and documentation procedures specified in NCP section 300.435(c)(2)(ii) are required.

It is recommended that a CAD/ROD amendment be prepared in accordance with Section 117(c) and (d) of CERCLA. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) section 300.435(c)(2)(ii) also addresses post-ROD information and public comment on post-ROD documentation.

6.0 REFERENCES

DOE, 1994. *Final Phase III RCRA Facility Investigation/Remedial Investigation*, Rocky Flats Plant, 881 Hillside Area, Operable Unit 1, Department of Energy, Rocky Flats Plant, Golden Colorado, June 1994.

DOE, 1995b. *OU-1, 881 Hillside Area, Corrective Measures Study/Feasibility Study,* Department of Energy, Rocky Flats Environmental Technology Site, Golden Colorado, February 1995.

DOE, 1996. *Final Rocky Flats Cleanup Agreement,* Department of Energy, Rocky Flats Environmental Technology Site, Golden Colorado, July 16, 1996.

DOE, 1997. *Corrective Action Decision/Record of Decision, Operable Unit 1,: 881 Hillside Area*, Department of Energy, Rocky Flats Environmental Technology Site, Golden Colorado, February, 1997.

EPA, 1989. *Guidance on Preparing Superfund Decision Documents*, Interim Final, July 1989

RMRS, 1995. *Sampling and Analysis Plan, Identification and Delineation of Contaminant Source Area for Excavation Purposes, Individual Hazardous Substance Site 119.1, Operable Unit 1.*

RMRS, 1996. *Sampling And Analysis Report, Identification and Delineation of Contaminant Source Area For Excavation Design Purposes*, IHSS 119.1, Operable Unit 1, Department of Energy, Rocky Flats Environmental Technology Site, Golden Colorado, April 1996.

RMRS, 1997a. *Sampling and Analysis Plan for the Downgradient Investigation of IHSS 119.1*, Department of Energy, Rocky Flats Environmental Technology Site, Golden Colorado, April, 1997.

RMRS, 1997b, *Sampling Analysis Plan for Implementation Samples for the IHSS 119.1 Source Removal Project*, Rocky Flats Environmental Technology Site, Golden, Colorado, RF/RMRS-97-009, Draft, April, 1997.

Appendix A
Borehole Logs

ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 12797
Location - North: _____ East: _____
Date: 051997
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: HSS 119.1 Downgradient
Total Depth: 14.0
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR
APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	0.0	0.0				GM/GC	0.0		
								0.5		Gravel-sand-silt-clay mixture, dark brown (10YR3/3), with traces dark (black) asphalt-like material. Entire interval may be artificial roadfill. Dry to slightly moist. No VOC hits/staining.
							CL			silty clay w/sand and gravel to clay w/silt and traces sand and gravel – very dark grayish brown (10YR3/2) to dark brown (7.5YR3/4 to dark brown (10YR3/3). Lattermost color predominates below 1.5'. Slightly moist. No VOC hits/staining. Gravels to ~1", average ~0.4".
								1.0		
	RUN 1: 0.0-3.0	2.5	N/A					2.0		
			05199							
	3.0	3.0	3.0					3.0		
	3.0	3.0	3.0							Same as above, clay w/silt and traces sand and gravel. Slightly moist. Color now brown, 10YR4/3. No VOC hits or staining.
	RUN 2: 3.0-5.0	1.6 (0.5 slough)	N/A					4.0		
	5.0	5.0	5.0							
	5.0	5.0	5.0				CH	5.0		clay with accessory sand – entire interval (5.0-8.7') looks like reworked bedrock claystone. Color is light olive brown (2.5Y5/3) to light brownish gray (2.5Y6/2), with orange-colored Fe oxide staining common. Slightly moist. Sandy seam at 6.75, sand grains at 7.7', and elsewhere. Occasional traces carbonaceous material. Reworked claystone to 8.7'.
	RUN 3: 5.0-8.0	3.3' (0.3 slough)	N/A					6.0		
								7.0		Below 8.7', core is mixture of reworked claystone with seams and pockets of silt-sand-gravel mixture and occasional larger gravel clasts (to >1"). Most of this mixture interval (9.0-9.5') consumed in samples. Slightly moist. No VOC hits or staining.
	8.0	8.0	8.0					8.0		
	8.0	8.0	8.0					8.7		
	RUN 4: 8.0-11.0	3.5 (0.1' slough)	BH 10002 BAR (VOCs only) BH 10002 RM (VOCs)				a/ GC	9.2		See above, 5.0-8.7, for description
9.7								9.5		TOP OF BEDROCK - claystone to claystone w/silt. Light brownish gray (2.5Y6/2) to grayish brown (2.5Y5/2) with Fe staining common. Abundant carbonaceous material @ 9.6-9.7'.
9.7								10.0		

BOX 1 OF 2: 0.0-9.7

(cont'd next page)

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

(4011-930-0134-930X Form GT.1A (03/01/92))

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 12797
Location - North: _____ East: _____
Date: 05/1997
Geologist: J. Boylan
Drilling Equip.: Geoprobe
Surface Elevation: _____
Area: IHSS 119.1 Downgradient
Total Depth: 14.0
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL LITHOLOGIC LOG	SAMPLE DESCRIPTION
										(cont'd from p.1 of 2)
↑ 9.7	↑ 8.0	see previous page	see previous page					10.0		Scattered caliche grains at 10.8-10.9' to ~0.3" diam. Slightly moist. No VOC hits or staining.
	11.0	11.0	11.0					11.0		
Box 2 of 2: 9.7-14.0'	11.0	11.0	11.0							Same as above, 9.5 - 11.0. More caliche at 11.6', 11.9'. Below ~12.7' (measuring down from 11.0'), core becomes crumbly, chippy; below ~13 - 13.4', claystone is fractured, healed w/ Fe oxides; fractures are of varying orientations, subvertical to subhorizontal. Material below 12.7' is dark gray (5Y 4/1). Slightly moist to near dry. No VOC hits or staining.
	Run 5: 11.0' - 14.0'	3.7 (0.1' slough)	N/A	/				12.0		
								13.0		
										NOTE: pockets of granulated bentonite are in core to mark top of next run / bottom of slough.
14.0	14.0	14.0	14.0					14.0		
										TD = 14.0'
								15.0		
								16.0		
								17.0		
								18.0		
								19.0		
								20.0		

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 1 OF 2

Borehole Number: 12897
Location - North: _____ East: _____
Date: 051497
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: ~~OU1~~ IHSS 119.1 Downgradient
Total Depth: 20.0
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	0.0	0.0				GM	0.0		Gravel-sand-silt mixture — moderate yellowish brown (10YR 5/4). Dry. Artificial fill?
	RUN 1:							0.4		
							CL			Silty clay with sand and gravel — dark yellowish brown (10YR 4/2) to grayish brown (5YR 3/2). Slightly moist. A few asphalt clasts @ top of interval cause PID/FID to register VOC's, but otherwise no hits or staining. Occasional gravels to >2" diam.
	0.0							1.0		
	4.0	2.9	N/A					2.0		
								2.9		NO RECOVERY
								3.0		2.9-4.0
	4.0	4.0	4.0					4.0		
BOX 1 OF 2 (0.0-12.7)	4.0	4.0	4.0							Same as above, w/ gravelly layer at 5.1-5.3'. Small "hits" on PID (to 1.5 ppm), nothing on FID, no staining; hits @ 4.1-4.9 or so. Collected this interval for samples. Below gravel is lens that's moderate yellowish brown (10YR 5/4). Under this @ 5.7-5.8' is thin lens of what looks like reworked bedrock, is CH (mod. to high plasticity)
	RUN 2:									
	4.0	3.5	BH00S9 RUN (VOCs) BH00S9MF (VOC screen)							
	7.0						CH	5.7		
								5.8		
							CL	6.0		
	7.0	7.0	7.0					7.0		Same as above
	7.0	7.0	7.0							
	RUN 3:							8.0		
	7.0	3.4	N/A							
	10.0							9.0		Sandy clay to gravelly, sandy, silty clay — moderate brown (5YR 4/4) to light brown (5YR 5/6). Slightly moist. NO VOC hits or staining. Fairly sharp upper contact, unknown lower contact.
							SC			
	10.0	10.0	10.0					10.0		

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 12897
Location - North: _____ East: _____
Date: 051397 051497 - 051597
Geologist: J Boylan
Drilling Equip.: Geoprobe
Surface Elevation: _____
Area: HSS 119.1 Downgradient
Total Depth: 20.0
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
Box 1 of 2: 0.0 - 12.7	10.0	10.0	10.0					10.0		
	Run #: 10.0 - 13.0	1.6	BH 12897 RM (VOCs) BH 12897 RMF (VOC screen)					11.0		NO RECOVERY 10.0 - 11.9
								11.9		
							CL	12.0		SAME AS ABOVE, 0.4 - 9.0
12.7	12.7							12.3		TOP OF BEDROCK (SAB 051597) silty claystone (SAB 051497) to siltstone, dark yellowish brown (10YR 4/2) to moderate yellowish brown (10YR 5/4) to, where fresh, pale yellowish brown (10YR 6/2). Hits to 6 ppm PID+FID below 13.0'. Slightly moist. Very broken up between 13.9 - 15'. numerous Fe-healed fracture faces evident in all the chips making up this interval. (Uncertain of orientations of fractures.) Fe-oxide staining common. Gets very silty below 13', to SILTSTONE (gradual transition).
Box 2 of 3: 12.7 - 20.0 EXCLUDING 16.0 - 18.0	13.0	13.0	13.0					13.0		
	Run 5: 13.0 - 16.0	4.0	BH 12897 RM (VOCs) BH 12897 RMF (VOC screen)					14.0		
								15.0		
	16.0	16.0	16.0					16.0		NOTE: HOLE NOT VERTICAL; HAD TO OFFSET AFTER 16', RESUME CORING & SAMPLING @ 16' IN NEW HOLE
Box 3 of 3: 16.0 - 18.0	Run 6: 16.0 - 18.0	4.0' (Grad. slough)	NA					16.0		NO RECOVERY (SAB) ← Replace "No Recovery" X with indicated pattern (SAB) 16.0 - 18.0 (SAB) Same as above: silty claystone to siltstone. To sandy siltstone below ~17.8'. 1" to 2" light tan sandy siltstone rip-up clast(?) present at ~17.4'.
	18.0							17.0		
	18.0	18.0	18.0					18.0		Siltstone to sandy siltstone - pale yellowish brown (10YR 6/2) to light olive gray (5Y 5/2). Dry to slightly moist. Fluffed up during drilling. Several fractures throughout, mostly at ~18.5', and mostly high-angle to subvertical. Sand is very fine-grained, and it is main, at 18 - 18.4'. Transition to clayey siltstone at 19.0', between light olive gray (5Y 5/2) and moderate olive brown (5Y 4/4), to olive gray (5Y 3/2) below 19.7'. No VOC hits or staining, but lots of Fe staining above 19.4', & numerous fractures (various orientations) 19.0 - 19.3.
19.0 ### 18.5 →	Run 7: 18.0 - 19.0	2.9	NA					19.0		
	19.0	19.0	19.0							
	Run 8: 19.0 - 20.0	2.1	NA					20.0		
20.0	20.0	20.0	20.0							TD = 20.0'

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 12997
Location - North: _____ East: _____
Date: 052097
Geologist: J. Boylan
Drilling Equip.: Geoprobe
Surface Elevation: _____
Area: HSS 119.1 / Downgradient
Total Depth: 12.0
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	0.0	0.0				SM	0.0		Sand-silt mixture with gravel and trace clay – dry to slightly moist dark brown (10YR 3/3). Rooted. NO VOC hits or staining.
	RUN 1: 0.0'-3.0'	1.6	N/A				GM	1.0		Gravel to silty sandy gravel with clay – very dark brown (10YR 2/2) slightly moist. Gravel to >2". NO VOC hits or staining.
							CL	1.6		clay with silt and traces sand and gravel – dark yellowish brown (10YR 4/4). Slightly moist. Malleable to sticky. No VOC hits or staining.
								2.0		NO RECOVERY 1.6-3.0
	3.0	3.0	3.0					3.0		Same as above, 1.0-1.6' except more sand and gravel – to clay with silt, sand, and gravel. Slightly moist. No VOC hits or staining
	3.0	3.0	3.0				GW/GM	3.7		Gravel with sand, silt and clay – top portion (to ~4.2') is dominated by what looks like fractured pieces of a single clast of quartzite. Gravel is dry matrix is slightly moist. Matrix is dark yellowish brown, 10YR 4/4. No VOC hits or staining
	RUN 2: 3.0'-6.0'	2.4' (0.4' slough)	N/A					4.0		
							CH	4.5		Reworked bedrock claystone with occasional traces sand and gravel. Grayish brown (2.5Y 5/2) w/Fe stained orange areas common. Slightly moist. 1" gravel clast at 4.9'. No VOC hits/stains. Moderate to high plasticity.
								5.0		NO RECOVERY 5.0-6.0'
	6.0	6.0	6.0					6.0		
	6.0	6.0	6.0							Same as above 4.5-5.0, with 1" gravel clast @ 6.2'. No VOC hits/stains.
	RUN 3: 6.0'-9.0'	3.2' 10.2'	BH 10063 BNF (VOC, sonic) BH 10063 BM (VOC)				SW/SC	6.5		Clayey sand-silt mixture w/gravel. Dark yellowish brown (10YR 4/4) to strong brown (7.5YR 4/6). Same to abundant gravel, 6.9-7.4'. Slightly moist. Abundant carbonaceous fragments @ 7.9', conserved by VOC sample. No VOC hits/stains.
								7.0		
								8.0 8.1		TOP OF BEDROCK
	9.0	9.0	9.0							claystone to claystone w/silt – grayish brown (2.5Y 5/2) with Fe staining common. Slightly moist. Malleable to 11.1'. Then turns chippy, crumbly, moderately friable.
	9.0	9.0	9.0					9.0		Color grades to grayish dark grayish brown below 11'. Fe-healed fractures of various orientations common below 11.1', also present ~10.5-10.6'.
	RUN 4 - see p2	see p2	N/A					10.0		

Box 1 of 2: 0.0 – 11.2

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 12997
Location - North: _____ East: _____
Date: 052097
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: IHSS 119.1 DOWNGRADIENT
Total Depth: 12.0
Company: TIERRA Project No.: _____
Sample Type: CONTINUOUS CORE

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
Box 1 of 2: 0.0-11.2	9.0	9.0						10.0		SEE PREVIOUS PAGE
11.2	Run 4: 9.0- 12.0	3.7' (0.2' slough)	N/A	1 x				11.0		
Box 2 of 2: 11.2-12.0										
12.0	12.0	12.0	12.0					12.0		TD = 12.0'
								13.0		
								14.0		
								15.0		
								16.0		
								17.0		
								18.0		
								19.0		
								20.0		

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 13097
Location - North: _____ East: _____
Date: 052097
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: IHSS 119.1 Downgradient
Total Depth: 18.0
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	0.0					CL	0.0		Gravelly, silty, sandy clay to clay with silt and traces sand and gravel — brown (10YR 4/3) at top to very dark grayish brown (10YR 3/2) below 0.7' to dark yellowish brown (10YR 3/4) below 1.5'. Slightly moist. Minor rooting @ top. No VOC hits/stains. Gravels to >2".
	RUN 1: 0.0-3.0	2.0	N/A					1.0		
								2.0		
	3.0	3.0	3.0					2.8		NO RECOVERY 2.8-3.0'
	3.0	3.0	3.0				CH	3.0		clay (3.0-3.2, 4.0-5.3') to clay with silt, sand, and traces gravel — footages noted composed of reworked bedrock, balance is colluvium/alluvium. "Bedrock" material is olive brown (2.5Y 4/3) to grayish brown (2.5Y 5/2), w/ Fe stained areas common and caliche clasts occasionally present. Balance is brown (10YR 4/3) to dark brown (7.5YR 4/4), incorporates most of the sand and gravel present from 3.0-6.0. Slightly moist. No VOC hits/stains. The reworked bedrock (logged as CH, at 3.0-3.2 and 4.0-5.3') has a moderate to high plasticity.
	RUN 2: 3.0-6.0	3.5 (<0.1' slough)	N/A				CL	3.2		
							CH	4.0		
								5.0		
								5.3		
	6.0	6.0	6.0				CL	6.0		
Box 1 of 3: 0.0-8.4'	6.0	6.0	6.0							Same as above, without any reworked bedrock (which occurred at 3.0-3.2 and 4.0-5.3'). Slightly moist. Occasional gravel clasts. No VOC hits/stains. ~~Fe-oxide stained pockets scattered throughout.~~ → Call 6.0-9.0 "silty clay with sand and traces gravel"
	RUN 3: 6.0-9.0	3.6	N/A					7.0		
								8.0		
8.1										
8.1										
	9.0	9.0	9.0				see next page	9.0		
Box 2 of 3: 8.4-12.0	9.0	9.0	9.0				SC/GC	9.1		Same as above, with gravel pocket (or single large clast, broken up by drilling) at 9.1-9.5. Increased gravel content relative to 6.0-9.0 run; call it ~~"silty clay with sand and gravel"~~ "gravelly sand-silt-clay mixture". Bottom 0.1' (11.3-11.4') is reworked bedrock mixed w/ coarse gravels (to >1.2") (cont'd next page)
	RUN 4: see next page	see next page	see next page					10.0		

or fractured gravel clast; quartzite

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

(4011-930-0134-930)(Form GT.1A)(03/01/92)

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 2 OF 2

Borehole Number: 13097
Location - North: _____ East: _____
Date: 052097
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: IHSS 119.1 Downgradient
Total Depth: 18.0
Company: Tierra Project No.: _____
Sample Type: continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL LITHOLOGIC LOG	SAMPLE DESCRIPTION
8.4 ↑	Run 4: 9.0-11.5	2.7 (0.3 ft slough)	11.5				SC/GC	10.0		(carried from previous page) Slightly moist. No VOC hits/stains. Additional gravel pocket at 11.0-11.3'.
See Note below								11.0		
Box 2 of 3 Run 5: 11.0-12.0 Recovered 4.0'	11.5 / 11.5 / 12.0	11.5 / 11.5 / 12.0	11.5 / 11.5 / 12.0	BH LOCATION (VOCs)				11.5		No recovery 11.4-11.5
12.0										052197 - Offset 1' N, began sampling at 11.0'. 11.0-12.0 is same as above; VOC hits to 1 ppm at 11.8-11.4' (collected for sample). Bottom 0.1' is coarse, fractured quartzite gravels.
	Run 6: 12.0-13.5 (Had to use solid point)	N/A	N/A				Approx. location	12.0		NO RECOVERY — Approximate top of bedrock = 12.5'
	13.5 / 13.5 / 13.5	13.5 / 13.5 / 13.5	13.5 / 13.5 / 13.5					12.5		12.0-13.5 (Had to use solid point) Interval is represented by 1.9' of slough, within which bedrock is present 0.8' from top of slough. Pick top of bedrock at 12.5' (includes allowance for slough from above 12.0') but note that top of bedrock may be elsewhere in the 12.0-13.5' interval.
	Run 7: 13.5-15.0	2.4 (incl. 1.9' slough)	N/A					13.0		
	15.0 / 15.0 / 15.0	15.0 / 15.0 / 15.0	15.0 / 15.0 / 15.0					13.5		
Box 3 of 3: 12.0-18.0	Run 8: 15.0-18.0	4.0 (incl. 0.6' slough)	N/A	1				14.0		NO RECOVERY 14.0-15.0
				1				15.0		Bedrock: claystone to claystone w/silt — grayish brown (2.5Y 5/2) to dark gray (10YR 4/1), w/Fe-staining turning some areas olive brown (2.5Y 4/3). Slightly moist. No VOC hits or staining. Scattered Fe healed fractures of various orientations, present @ 17.5, 16.0-17.0; also a textbook example of an ironstone nodule, 1" diam., at 17.8'.
				1				16.0		
				1				17.0		
18.0	18.0	18.0	18.0	18.0				18.0		TD = 18.0'
								19.0		
								20.0		

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

NOTE See logbook ER-IHSS119.1-LB-97-25, pp 50-53, for discussion of offset. On 052197, offset, resumed sampling at 11.0'. Run 5 = 11.0-12.0', 4.0' recovery (including 3.0' slough).

ALSO: See pp 54-55 for discussion of bedrock pick.

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(4011-930-0134-930)(Form GT.1A)(03/01/92)

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 1 OF 2

Borehole Number: 13197
Location - North: _____ East: _____
Date: 060397
Geologist: J. Baylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: IHSS 119.1 Downgradient
Total Depth: 16.0'
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	0.0	0.0					0.0		
	RUN 1: 0.0-4.0	4.0	N/A				SM	0.6		Silt-clay sand mixture w/gravel and clay – dark brown (10YR 3/3) to very dark grayish brown (10YR3/2). Dry to slightly moist. Rooted. No VOC hits. Transitional lower contact.
							CL	1.0		Silty clay w/traces sand and gravel – dark brown (10YR3/3) to brown (10YR 4/3). Slightly moist, stiff, somewhat malleable. No VOC hits.
								2.0		
								3.0		
	4.0	4.0	4.0					4.0		
	4.0 RUN 2: 4.0-7.0	3.8 (incl. 0.6' slough)	N/A					5.0		Same as above, 0.6-4.0'. Color gradually changes to strong brown (7.5YR 4/6) to brown (7.5YR 4/4) w/ increasing depth. Slightly moist. No VOC hits. Gravelly @ base (below 6.8').
								6.0		
	7.0	7.0	7.0					7.0		
	7.0 RUN 3: 7.0-10.0	0.5' (all slough)	N/A					8.0		NO RECOVERY 7.0-10.0'
								9.0		
↓ BOX 1 OF 2 : 0.0-11.0'	10.0	10.0	10.0					10.0		

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 2 OF 2

Borehole Number: 13197
Location - North: _____ East: _____
Date: 060397
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: LHSS 119.1 Downgradient
Total Depth: 16.0'
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
Box 1 of 2: 0.0-11.0	10.0 / Run 1: 10.0-11.0	1.3' (all slough)	N/A					10.0		NO RECOVERY 10.0-11.0
Box 2 of 2: 11.0-16.0	11.0 / 13.0 / Run 5: 11.0-13.0	3.0' (1.1' slough)	B14 (00 71 Rm (rock) + fissures) B4 (00 72 Rm (VOC's)	/	/		GM/GC	11.0		Gravel-sand-silt-clay mixture — gravel predominates, much of which is fractured by drilling. Matrix color is brown 7.5YR 4/4, slightly moist. No VOC hits. Most matrix from 11.5-12.0' consumed by samples, together w/ top 0.5" of bedrock. Fractured gravels may indicate gravel-rich material above, in 7.0-11.0 interval. Also present in 7.0-11.0 interval, though only recovered as slough.
								12.0		TOP OF BEDROCK (3 thin zone of reworked bedrock)
								12.9		Claystone — light olive brown (2.5Y 5/3) to dark gray (10YR 4/1). Fe-staining common, carbonaceous flecks occasionally present. Typical mottled coloration. Slightly moist. No VOC hits.
	13.0 / Run 6: 13.0-16.0	2.9' (incl. 1.1' slough)	N/A	/	/			13.0		NO RECOVERY 12.9-13.0
								14.0		Same as above, 12.0-12.9'. Fractures of various orientations present throughout. Caliche clasts rare, but present. Slightly moist. No VOC hits.
								14.8		
	16.0	16.0	16.0					15.0		NO RECOVERY 14.8-16.0
								16.0		TD = 16.0'
								17.0		
								18.0		
								19.0		
								20.0		

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 13297
Location - North: _____ East: _____
Date: 052397
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: IHSS 119.1 Downgradient
Total Depth: 15.0
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	0.0	0.0				SM	0.0		Clayey sand-silt mixture w/gravel – dark brown (10YR 3/3) to dark yellowish brown w/depth (10YR 4/4). Dry to slightly moist. Rooted. No VOC hits. Silttier in top, darker 0.2'; sandier in bottom, yellower, 0.4'.
	Run 1: 0.0-4.0	0.6	N/R					0.6		NO RECOVERY 0.6-4.0
								1.0		
								2.0		
								3.0		
	4.0	4.0	4.0					4.0		silty clay with trace to some sand and occasional trace gravel – very dark grayish brown (10YR 3/2) at top 0.6', lightening to dark brown (10YR 4/3) and dark yellowish brown (10YR 4/4) w/depth. (Uppermost may be ~~slough~~ core recovered from Run 1 – unable to tell.) Occasional areas of carbonaceous flecks (not evenly distributed throughout). Slightly moist. No VOC hits/stains.
Box 1 of 2: 0.0-11.0	4.0	4.0	4.0				CL			
	Run 2: 4.0-8.0	4.0 (compacted - at least some from Run 1)	N/A					5.0		
								6.0		
								7.0		
	8.0	8.0	8.0					8.0		Same as above 4.0-8.0. Still slightly moist, no VOC hits/stains.
	8.0	8.0	8.0							
	Run 3: 8.0-11.0	Total 7.40	N/A					9.0		
11.0 ↓								10.0		

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 13297
Location - North: _____ East: _____
Date: 052397 / 052797
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: IHSS 119.1 Downgradient
Total Depth: 15.0
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
Box 1 of 2: 0.0-11.0	See previous page						CL	10.0		(See previous page)
11.0	11.0	11.0	11.0					11.0		Same as above, 4.6-11.0. Slightly moist. No VOC hits/stains. Gravel throughout 11.1-11.6', most of which was consumed in sample (excluding gravel).
11.0	11.0	11.0	11.0					11.6		TOP OF BEDROCK
Box 2 of 2: 11.0-15.0	Run 4: 11.0-13.0	4.0 (ind. 2.5' sloughed)	BHXXXXXXXX (VOC)					12.0		Claystone to claystone w/silt - light brownish gray (2.5Y 6/2) to light yellowish brown (2.5Y 6/4). Slightly moist. No VOC hits/stains. Fe staining common throughout.
13.0	13.0	13.0	13.0							NO RECOVERY 12.5 - 13.0
13.0	13.0	13.0	13.0					13.0		Same as above; gradually decreasing Fe-staining w/depth. Caliche pockets present but rare. Carbonaceous flecks thinly scattered throughout.
15.0	Run 5: 13.0-15.0	3.6 (ind. 1.4' sloughed)	N/A					14.0		
15.0	15.0	15.0	15.0					15.0		TD = 15.0'
								16.0		
								17.0		
								18.0		
								19.0		
								20.0		

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 1 OF 2

Borehole Number: 13397
Location - North: _____ East: _____
Date: 052297
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: HSS 119.1 Downgradient
Total Depth: 20.0
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR
APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0		0.0				CL	0.0		clay with silt, sand, and gravel (0.0-0.7) to clay with silt and occasional traces sand and gravel (0.7-2.9). Dark yellowish brown in former (10YR 4/4) to dark brown in latter (10 YR4/3). Moist to slightly moist. Gravels to >2". Occasional clasts of caliche. No VOC hits/stains. Some gravel @ top may be artificial road fill.
	RUN 1: 0.0 4.0	2.9	NA					1.0		
								2.0		
								2.9 3.0		NO RECOVERY 2.9-4.0
	4.0	4.0	4.0					4.0		
	4.0	4.0	4.0							same as above w/ more gravel @ 7.0' and reworked bedrock @ 7.4-8.0 (color is light brownish gray, 2.5Y 6/2, w/ more yellowed pockets of Fe-staining). No VOC hits/stains.
	RUN 2: 4.0 8.0	4.0 (incl. 0.1 slough)	N/A					5.0		
								6.0		
								7.0		
								7.4		Reworked bedrock, as described above; moderate to high plasticity
	8.0	8.0	8.0					8.0 8.0		
	8.0	8.0	8.0				CH			same as above: reworked bedrock continues to 9.7', below which the same clay & silt and occasional traces sand and gravel that is present above the reworked bedrock slump block. Occasional Fe staining in slump block. No VOC hits/stains
	RUN 3: 8.0-11.5	4.0 (incl. 0.1 slough)	N/A					9.0		
9.9							CL	9.7 10.0		same as above, 0.0-7.0

BOX 1 OF 3 : 0.0-9.9

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 13397
Location - North: _____ East: _____
Date: 052297
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: IHSS 119.1 Downgradient
Total Depth: 20.0
Company: Tetra — Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR
APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL LITHOLOGIC LOG	SAMPLE DESCRIPTION
9.9							CL	10.0		
			N/A					11.0		
	11.5	11.5	11.5					11.5		
	11.5	11.5	11.5					12.0		Same as above (above & below reworked bedrock). Redder coloration @ 11.9-12.2' probably from rotting Fountain Fm clast. More orange (to strong brown, 7.5YR5/6) below 13.1', accompanied by increased gravel content, to gravelly, sandy, silty clay — not quite GC or SC, but close.
	RUN 4: 11.5-14.0	3.5 (incl. 0.7' slough)	N/A					13.0		
	14.0	14.0	14.0					14.0		
	14.0	14.0	14.0					14.6		Same as above, 13.1-14.0. Interval from 14.6-15.3 is reworked bedrock lens, light brownish gray (2.5Y 6/2) w/ Fe stained areas (light yellowish brown, 2.5Y 6/4, to brownish yellow, 10YR 6/8). Wet throughout interval, 14.0-15.3, probably from rain. No VOC hits.
	RUN 5: 14.0-17.0	3.6 (incl. 1.0' slough)	BH 10065 RM (sec.)				CH / GM/SC	15.0		Silty, clayey sand-gravel mixture. Includes rotten gravels. Saturated (probably from rain). No VOC hits. All but coarser gravels collected for sample. Color red (2.5YR 5/6) to yellowish brown (10YR 5/4).
								15.8		TOP OF BEDROCK
								16.0		Claystone to claystone with silt —
								16.2		Light brownish gray (2.5Y 6/2) to lt yellowish brown (2.5Y 6/3). Scattered Fe staining, scattered carbonaceous flecks. No VOC hits, slightly moist, w/ saturated exterior (from rain water).
								16.6		NO RECOVERY 16.6-17.0
17.0	17.0	17.0	17.0					17.0		Same as above, 15.8-16.6.
17.0	17.0	17.0	17.0							
	RUN 6: 17.0-20.0	2.5 (incl. 1.3' slough)	N/A					18.0		
								18.2		NO RECOVERY 18.2-20.0
								19.6		
20.0	20.0	20.0						20.0		TD = 20.0

Box 2 of 3: 9.9-17.0

Box 3 of 3: 17.0-20.0

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

3L

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 1 OF 2

Borehole Number: 13497
Location - North: _____ East: _____
Date: 052997
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: IHSS 119.1 Downgradient
Total Depth: 20.0'
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	0.0	0.0				CL	0.0		Silty clay to clay w/silt, and w/traces sand and gravel — dark yellowish brown (10YR 4/4) in top 0.3', then sharp change to very dark grayish brown (10YR 3/2), which gradually lightens to dark brown (10YR 4/3). Slightly moist. Top 0.3' is both siltier and dryer than rest of run. No VOC hits. Gravel clasts rare. Top 0.3' is rooted. Occasional carbonaceous flecks.
	RUN 1: 0.0 - 4.0	4.0	N/A					1.0		
								2.0		
								3.0		
	4.0	4.0	4.0					4.0		Same as above, 0.3 - 4.0, ~~lighter~~ to dark brown (10YR 4/3) to dark yellowish brown (10YR 4/4). No VOC hits.
	4.0	4.0	4.0							
	RUN 2: 4.0 - 7.0	4.0 (incl. 0.3' sloughed)	N/A					5.0		
								6.0		
	7.0	7.0	7.0					7.0		Same as above, 0.3 - 7.0
	7.0	7.0	7.0							
7.6	RUN 3: 7.0 - 9.0	2.0 (incl. 0.5' sloughed)	N/A					8.0		
7.0								8.7		Gravel-sand-silt mixture w/clay — strong brown (7.5YR 5/6). Slightly moist. No VOC hits. Contains drill-fractured gravels.
	9.0	9.0	9.0				SM/GM	8.9		NO RECOVERY 8.9-9.0
	9.0	9.0	9.0					9.0		Same as above, 8.7-8.9'. No VOC hits.
	See next page							9.6		
							CH	10.0		Reworked bedrock — light olive brown (2.5Y 5/4) where Fe-stained, to light brownish gray (2.5Y 6/2) where fresher. (cont'd next page)

Box 1 of 3: 0.0 - 7.6
Box 2 of 3: 7.6 -

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

B7

(4011-930-0134-9 10)Form GT.1A(10)01/92)

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 13497
Location - North: _____ East: _____
Date: 052997/060297
Geologist: J. Boylan
Drilling Equip.: Geoprobe
Surface Elevation: _____
Area: LHSS 119.1 Downgradient
Total Depth: 20.0'
Company: Ikona Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/LITHOLOGIC LOG	SAMPLE DESCRIPTION
Box 2 of 3: 7.6-14.0'	Run 4: 9.0-12.0	4.0 (incl. 0.5' slough)	N/A				CH	10.0		Carbonaceous flecks common - slightly moist, malleable. No VOC hits.
							CL	11.0		Same as above, 0.3-7.0', with ~0.05' of material described at 8.7-9.6' between the CH and this CL (too thin to break out separately). No VOC hits.
052997 060297	12.0	12.0	12.0					12.0		
	12.0 Run 5: 12.0-14.0	12.0 4.0' (incl. 2.5' slough)	12.0 N/A					13.0		Same as above, 0.3-7.0', with increased gravel content below 13.3'. The 2.5' of slough is saturated & contains many "pillbugs." No VOC hits. In contrast to slough, core is slightly moist.
								13.5		NO RECOVERY 13.5-14.0'
14.0	14.0	14.0	14.0					14.0		
14.0	14.0 Run 6: 14.0-16.0'	14.0 3.8' (incl. 1.2' slough)	14.0 N/A				CH	14.3		Same as above, 13.3-13.5'; the 1.2' of slough is saturated.
							GM/SM	14.6		Reported bedrock. Not clean; contains mud, gravel, except for central portion.
								15.0		Gravel-sand-silt mixture w/clay - reddish yellow (7.5YR 6/8) to strong brown (7.5YR 5/6, 5/8). Rotted gravels present. No VOC hits. Slightly moist. Variegated colors due to varying clay content & rotting gravels. Looks very much like above interval, 8.7-9.6'. (The "GM" and the "SM" can be put in either order in both intervals.)
	16.0	16.0	16.0					16.0		
Box 3 of 3: 14.0-20.0'	16.0 Run 7: 16.0-18.0	3.3' (incl. 1.4' slough)	N/A					17.0		Same as above, 14.6-16.0'. Slough is not saturated this run. No VOC hits. Slightly moist.
	18.0	18.0	18.0					17.9		18.0-18.1 is same as above, 14.6-17.5'. NO RECOVERY: 17.9-18.0
	18.0 Run 8: 18.0-20.0	18.0 3.7' (incl. 1.3' slough)	18.0 BIT LOST TO RUN CORED					18.0 18.1		TOP OF BEDROCK Claystone - light olive brown (2.5Y 5/3) to 18.8', changing to very dark gray (from 5Y 3/1 to 10YR 3/1). Fe-stained fractures very common in darker material with olive material stained throughout rather than along discrete fracture faces. Fractures of varying orientations. Slightly moist. No VOC hits. Most of slough returned to upper portion of hole during abandonment.
								19.0		
20.0	20.0	20.0	20.0					20.0		

TD = 20.0'

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 13597
Location - North: _____ East: _____
Date: 052897 / 052997
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: HSS 119.1 Downgradient
Total Depth: 20.0
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR
APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	0.0	0.0				CL	0.0		silty clay w/ sand and gravel - brown (10YR4/3) to very dark grayish brown (10YR3/2), w/ color darkening below 1.1'. Zone from 0.8 to 1.1 is dark brown 7.5YR4/4. Some areas sandier and more gravel than elsewhere (as at 0.2-0.4', 1.1-1.4') but overall is CL. Slightly moist. Lightly rooted @ top. No VOC hits.
	Run 1: 0.0' 4.0	4.0	N/A					1.0		
								2.0		
								3.0		
	4.0	4.0	4.0					4.0		Same as above 0.0-4.0, but free of the coarser lenses (0.2-0.4, 1.1-1.4). Color is dark yellowish brown (10YR4/4) below ~4.6' (gradual lightening from very dark grayish brown, 10YR3/2). No VOC hits.
	4.0	4.0	4.0							
	Run 2: 4.0' 7.0	4.0 (incl. 0.1' slough)	N/A					5.0		
								6.0		
	7.0	7.0	7.0					7.0		Same as above, 4.0-7.0. Slightly moist. No VOC hits.
	7.0	7.0	7.0							
7.5	Run 3: 7.0' 9.0	2.3 (incl. 0.7' slough)	N/A					8.0		
7.5							GW	8.4		Gravel, fragmented, no matrix. Dry. No VOC hits. Grading is an artifact of fracturing during drilling.
								8.6		NO RECOVERY 8.6-9.0
	9.0	9.0	9.0					9.0		
	9.0	9.0	9.0				GM/SM			Gravel-sand-silt mixture w/ trace to some clay - strong brown 7.5YR5/6. Dry to slightly moist. No VOC hits. Coarser at top. The GW at 8.4-8.6 may be top of GM/SM instead. Rotting gravel clasts common.
	See next page							9.9		
							CH	10.0		See next page

Box 1 of 3: 0.0-7.5
Box 2 of 3: 7.5-15.0
052997 052897

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 13597
Location - North: _____ East: _____
Date: 052997
Geologist: J. Baylen
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: HSS 119.1 DOWNGRADIENT
Total Depth: 20.0
Company: TERRA Project No.: _____
Sample Type: CONTINUOUS CORE

EG&G LOGGING SUPERVISOR
APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/LITHOLOGIC LOG	SAMPLE DESCRIPTION
	Run 4: 9.0-12.0	3.0 (incl. 0.6' sloughed)	N/A				CH	10.0		Reworked bedrock = light yellowish brown (2.5Y 6/3) to light olive brown (2.5Y 5/3).
							GM	10.4		Gravel-sand-silt mixture w/ clay — many colors, due to presence of rotting gravels, but dominantly strong brown (7.5YR 5/6). Redder @ 11.3-11.5 due to rotting Fountain Fm. clasts. Slightly moist. No VOC hits. Many gravel clasts are fragments of larger clasts, broken during drilling.
	12.0	12.0	12.0					11.0		
	12.0	12.0	12.0					11.5		
							CH	11.9		Reworked bedrock - same as above, 9.9-10.4, but with more gravel mixed in.
								12.0		
							GM			Same as above, 10.4 - 11.5. Slightly moist. No VOC hits. Color varies from strong brown (as above) to dark yellowish brown (10YR 4/6).
Box 2 of 3: 7.5-15.0	Run 5: 12.0-15.0	3.2 (incl. 1.1' sloughed)	N/A					13.0		
								14.2		
								14.1		NO RECOVERY 14.1 - 15.0
15.0	15.0	15.0	15.0					15.0		
15.0	15.0	15.0	15.0					15.4		TOP OF BEDROCK
	Run 6: 15.0-18.0	4.0 (incl. 1.2' sloughed)	BH 10069 RUN (VOCs) BH 10069 RUN DUP (VOCs)					16.0		Claystone — Top 1.5' of bedrock (15.0-16.5) in the form of thin elongated ribbons due to bit pushing rock ahead of it. This material contained by sampler. Color: olive yellow (2.5Y 6/6) where Fe-stained to light brownish gray (2.5Y 6/2). Slightly moist. No VOC hits.
Box 3 of 3: 15.0-20.0								17.0		
	18.0	18.0	18.0					17.2		NO RECOVERY 17.8-18.0
	18.0	18.0	18.0					18.0		Same as above, 15.0-17.8. More friable & crumbly except @ 18.6-19.2', where it is malleable. Fe-oxide-healed fractures of various orientations common. Color as above, to grayish brown & dark grayish brown (2.5Y 5/2, 2.5Y 4/2).
	Run 7: 18.0-20.0	4.0 (incl. 1.5' sloughed)	N/A					19.0		
20.0	20.0	20.0	20.0					20.0		TD = 20.0'

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 1 OF 2

Borehole Number: 13697
Location - North: _____ East: _____
Date: 052797
Geologist: J. Boylan
Drilling Equip.: Geoprobe
Surface Elevation: _____
Area: IHSS 119.1 Downgradient
Total Depth: 19.0
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	0.0	0.0				SM	0.0		Clayey silt-sand mixture to clay-silt-sand mixture w/ trace to some gravel – brown (10YR 4/3) to very dark grayish brown (10YR 3/2). Dry to slightly moist. Rooted. No VOC hits. Variegated coloration. Hard, stiff in places.
	RUN 1: 0.0-4.0	3.3	N/A					0.8		
							CL	1.0		Silty clay with trace to some sand, trace gravel – very dark grayish brown (10YR 3/2). No VOC hits.
							GC/GM	1.9		Gravel with sand, silt, and clay – mostly fractured gravel clasts. Matrix is brown (10YR 4/3) to dark yellowish brown (10YR 4/4). Slightly moist. No VOC hits.
								2.0		
								2.7		Thin lens of reworked bedrock clay, mod-high plasticity, mostly light yellowish brown (2.5Y 6/4) from Fe-staining. No VOC hits.
							CH	3.0		
							CL			Silty clay w/ trace to some sand, trace gravel – dark yellowish brown, 10YR 4/4 No VOC hits. Slightly moist.
								3.3		NO RECOVERY 3.3-4.0
	4.0	1.0	4.0					4.0		
	4.0	4.0	4.0							Same as above, 3.0-3.3. No VOC hits.
	RUN 2: 4.0-7.0	4.0 (incl. 1.1' sloughed)	N/A					5.0		
								6.0		
	7.0	7.0	7.0					6.9		NO RECOVERY 6.9-7.0
	7.0	7.0	7.0					7.0		Same as above, 3.0-3.3. No VOC hits. Slight increase in gravel content (still only at trace) below ~9.5'.
	RUN 3: 7.0-10.0	4.0 (incl. 0.5' sloughed)	N/A					8.0		
3.4										
3.4								9.0		
Box 2 of 3										
	10.0	10.0	10.0					10.0		

Box 1 of 3 : 0.0 - 8.4

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 2 OF 2

Borehole Number: 13697
Location - North: _____ East: _____
Date: 05 27 97
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: HSS 119.1 Downgradient
Total Depth: 19.0
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

Box 2 of 3 8.4/4.2

Box 3 of 3: 14.2-19.0

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
	10.0	10.0	10.0				CL	10.0		Same as above, 3.0-3.3'; w/gravel of 9.5-10.0'. No VOC hits.
	RUN 4: 10.0-13.0	4.0 (incl. 0.7' slough)	N/A				GC	10.8		Gravel-sand-clay-silt mixture - light to dark yellowish brown (10YR 6/4 to 10YR 4/4). Slightly moist. Gravels to > 2" diam; many broken gravel fragments recovered. No VOC hits. Very gradual transition from overlying CL to GC.
	13.0	13.0	13.0					11.0		
	13.0	13.0	13.0					12.0		
14.2	RUN 5: 13.0-15.0'	3.5 (incl. 1.1' slough)	N/A					13.0		Same as above, 10.8-13.0. No VOC hits.
14.2								14.0		
	15.0	15.0	15.0					15.0		Same as above, 10.8-13.0. No VOC hits.
	15.0	15.0	15.0					15.9		
	RUN 6: 15.0-17.0	3.7 (incl. 0.6' slough)	BH1009 7/24 (VOCs)					16.2		Top of bedrock - (smeared upper contact) Claystone to claystone w/silt - a few gravel clasts pushed into this material from above. Light brownish gray (2.5Y 6/2) to grayish brown (2.5Y 5/2), with Fe staining heavy at 15.8-16.2 turning color to olive yellow (2.5Y 6/6), staining less common below 16.2. Carbonaceous flecks common. Color darkens to grayish brown (2.5Y 5/2) to dark grayish brown (2.5Y 4/2) below 17.4' then shows Fe staining from 18.2 - TD and is olive brown (2.5Y 4/3). Slightly moist. No VOC hits. Occasional Fe-healed fractures of various orientation.
	17.0	17.0	17.0					17.0		
	17.0	17.0	17.0					18.0		
	RUN 7: 17.0-19.0	3.5 (incl. 1.0' slough)	N/A					19.0		TD = 19.0'
19.0	19.0	19.0	19.0					20.0		

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 1 OF 2

Borehole Number: 13797
Location - North: _____ East: _____
Date: 052897
Geologist: L Boylan
Drilling Equip.: Geoprobe
Surface Elevation: _____
Area: IHSS 119.1 Downgradient
Total Depth: 17.0
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	0.0	0.0				SC	0.0		Sandy clay w/gravel and silt to clayey sand w/gravel and silt — mottled browns & reds; brown (10YR 4/3) to reddish brown (5YR 4/4) (latter in clay pocket). Slightly moist. No VOC hits. Rooted.
	Run 1: 0.0-4.0	3.8	N/A				SM	0.8 / 1.0		silty sand w/clay and gravel — very dark brown (10YR 2/2). Slightly moist. No VOC hits.
							CL	1.8 / 2.0		clay w/silt, sand, and trace (<1%) gravel — very dark grayish brown (10YR 3/2) at top, gradually lightening to dark brown (10YR 4/3) w/depth. Abrupt change from overlying SM to clay unit. Gravel is rare, overall present in only trace quantities. Slightly moist. No VOC hits.
	4.0	4.0	4.0					3.8		NO RECOVERY 3.8-4.0
	4.0	4.0	4.0					4.0		Same as above, 1.8-3.8'. No VOC hits.
	Run 2: 4.0-7.0	4.0 (ind. 0.2' slough)	N/A					5.0		
	7.0	7.0	7.0					6.0		
	7.0	7.0	7.0					7.0		Same as above, 1.8-3.8'. No VOC hits. Occasional Fe-oxide grains & stains, occasional edit smears.
7.6	Run 3: 7.0-10.0	4.0 (ind. 1.0' slough)	N/A					8.0		
7.6								9.0		
Box 2 of 3 7.6-14.6	10.0	10.0	10.0					10.0		

Box 1 of 3 : 0.0-7.6'

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 13797
Location - North: _____ East: _____
Date: 052897
Geologist: J. Baylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: IHSS 119.1 Downgradient
Total Depth: 17.0
Company: Tierra — Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
↑	10.0	10.0	10.0				CL	10.0		Same as above, 1.8-3.8. No VOC hits. Gradual transition to underlying material.
	RUN 4: 10.0-13.0	4.0 (incl. 0.7' slough)	N/A					11.0		
							GC/SC	11.3		Gravel-sand-clay-silt mixture — yellowish brown (10YR 5/6) to strong brown (7.5YR 5/6). Coarsens w/increasing depth. Gravels to > 2"; much of gravel fraction is broken fragments. Slightly moist. No VOC hits.
								12.0		
Box 2 of 3: 7.6-14.6'	13.0	13.0	13.0					13.0		
	13.0	13.0	13.0					13.2		TOP OF BEDROCK
	RUN 5: 13.0-15.0	3.6' (incl. 1.1' slough)	BH 10068RM (Vacc)							Claystone — dark grayish brown (10YR 4/2) with Fe-staining common. Caliche clasts rare; carbonaceous flecks scattered throughout. Slightly moist. No VOC hits. Contact consumed by sample.
14.6								14.0		
14.6	15.0	15.0	15.0							
	15.0	15.0	15.0					15.0		Same as above 13.2-15.0. Interesting Fe-staining at 15.0-15.3, w/near vertical dividing line between fresh (gray) and stained (orange) material. Slightly moist. No VOC hits. Occasional fractures of varying orientation.
Box 3 of 3: 14.6-17.0	RUN 6: 15.0-17.0	3.1' (incl. 0.8' slough)	N/A					16.0		
17.0	17.0	17.0	17.0					17.0		TD = 17.0
								18.0		
								19.0		
								20.0		

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 1 OF 1

Borehole Number: 12197
Location - North: _____ East: _____
Date: 050697
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: IHSS 119.1 (Source)
Total Depth: 8.0
Company: Dietz Project No.: _____
Sample Type: Continuous Core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	0.0	0.0-0.2: BH1002 (Geoprobe 97)				SM	0.0		Sandy silt w/clay. Slightly moist. Some organics. Dk yellowish brn (10YR4/2)
	Run 1: 0.0-2.0	1.0	0.2-2.5: BH1002GRN				CL	0.2		Clay with silt, sand, and gravel. Stiff. Slightly moist. Color grades from darker brown to redder to more olive w/ increasing depth. Mod dk yellowish brn (10YR4/2)
								1.0		NO RECOVERY 1.0-2.0
	2.0	2.0						2.0		
	Run 2: 2.0-2.5	0.6					GW/GC	2.5		Mixture: gravel, slough (~0.2'), and gravelly sandy clay. Slightly moist. Color as above
	2.5	2.5								
	Run 3: 2.5-5.0'	2.1	2.5-4.0: BH1002 TRM (rads); 4.0-4.3: BH1002 BRMF (wet screen); 4.3-4.6 BH1002 BRM (rads)				GC	3.0		Same as above, w/ lens of lighter clay @ 3.3-3.4. Moderate yellowish brn (10YR5/4) to Moderate brown (5YR3/4). Clay lens is dusky yellow & light olive gray (5Y6/4, 5Y5/2) streaked & mottled. Clays to GC than GW, w/ clay lens @ CH (it is reworked bedrock). Lens is CH, but too thin to break out in log.
								3.3 3.4		
								4.0		
								4.6		NO RECOVERY 4.6-5.0
	5.0	5.0						5.0		Same as above but looser, drier; much of this is rock flour, fractured gravels from geoprobe hammering. No staining.
	Run 4: 5.0-8.0	2.8	5.6-8.0 NO SAMPLE					5.6		TOP OF BEDROCK @ 5.6'
								6.0		Bedrock: Claystone to silty claystone. Light olive gray (5Y5/2) to dusky yellow (5Y6/4) w/ Fe streaks. Darkens, fewer Fe areas below 7.0' - almost to olive gray (5Y3/2). No visible bedding. Dry to slightly moist. No staining. No fractures evident.
								7.0		~~TOP OF BEDROCK~~ (LAD) 050697
								7.2		
								7.8		NO RECOVERY 7.8-8.0'
								8.0		TD = 8.0'
								9.0		
								10.0		

Box 1 of 1

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 1 OF 2

Borehole Number: 12297
Location - North: _____ East: _____
Date: 050797
Geologist: J. Baylan
Drilling Equip.: Geoprobe
Surface Elevation: _____
Area: LHSS 119.1 (source)
Total Depth: 11.0
Company: Tierra — Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	0.0	0.0				CL	0.0		Silty clay w/sand and gravel — grayish red (10R4/2) to very dusky red (10R2/2) to grayish brown (5YR3/2). No staining or hits. Rooted in top 0.5'. Stiff, fairly hard. Gravel thinly scattered except @ bottom 0.3', where there is more gravel. Slightly moist, close to SC, but more like CL
	RUN 1 0.0-2.5	1.8	BH 10030 RM					1.0		
	2.5 2.5	2.5	2.5					2.0		NO RECOVERY 1.8 - 2.5
	RUN 2 2.5-5.0	2.5	BH 10031 RM (coals) (VOCs) BH 10032 RM (VOCs) BH 10032 RMF (VOC screen)					3.0		Same as above, but moderate yellowish brown (10YR5/4) with single larger gravel clast @ 2.8, single or multiple clasts @ 4.5-5.0'. No staining or hits.
	5.0 5.0	5.0	5.0					4.0		
	5.0 5.0	0.0	5.0					5.0		Reworked bedrock, 5.0 - 5.4'; balance of run is same as above, but pale yellowish brown (10YR6/2) to light olive gray (5Y5/2) to 5.4', then increase in sand content and color now moderate brown (5YR4/4) to dk. yellowish brown (10YR4/2). Scattered gravels, including rotted Fountain Fm. included in BH 10033 RMF. Some to abundant gravel below 6.1', but samples are CL.
	RUN 3 5.0-8.0	2.2	BH 10033 RM (VOCs) BH 10033 RMF (VOC screen)				CH / CL	6.0		
	8.0 8.0	0.0	8.0					7.0		TOP OF BEDROCK @ 7.0'; NO RECOVERY 7.2-8.0
	8.0 8.0	0.0	8.0					7.2		Claystone to clay stone, light olive gray (5Y5/2) w/ Fe streaks, occasional carbonaceous flecks. No bedding observed. Slightly moist. Darkens below 9.7' to dark yellowish brown (10YR4/2) to olive gray (5Y3/2). A few sub-vertical Fe-oxide healed fractures at 9.7-10.0'; above this is zone w/more Fe staining, below is relatively fresh, almost unstained.
	RUN 4 8.0-11.0	3.3	BH 10034 RM					8.0		
								9.0		
								10.0		TD = 11.0' ↓ (see next page

Box 1 of 1 : 0.0-11.0

Delete pattern this interval is NO RECOVERY STAND 050797

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched; accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 12297
Location - North: _____ East: _____
Date: 050797
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: HSS 119.1 Source
Total Depth: 11.0
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
SEE P. 1 OF 2								10.6		Claystone to claystone 2½: ft; see p. 1 of 2 for description.
11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0		TD = 11.0'

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 12397
Location - North: _____ East: _____
Date: 050897
Geologist: J. BOYLAN
Drilling Equip.: GEOPROBE

Surface Elevation: _____
Area: LHSS 119.1 SOURCE
Total Depth: 16.0
Company: TIERRA Project No.: _____
Sample Type: CONTINUOUS CORE

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	0.0								
	RUN 1: 0.0-2.5	1.5	BH10035RM				CL	0.0		Silty clay, w/some sand at 0.0-0.3, traces gravel throughout; to some or abundant gravel below 1.4'. Dusky yellowish brown (10YR 2/2) to dark yellowish brown (10YR 4/2), w/former color mainly in uppermost 0.5', slightly moist, pliable. No staining or hits. Gravel @ base of recovery cut from single clast - may be boulder(s) at 1.5-2.5'.
								1.0		
								1.5		NO RECOVERY 1.5-2.5
								2.0		
	2.5	2.5	2.5				TOL?	2.5		
	2.5	2.5	2.5				GC			Gravel-sand-clay-silt mixture. Some to abundant gravels (to >1") w/pods of sandy silty clay intermixed. Occasional chunk of what looks like Fe-stained bedrock claystone also present - Dominant matrix color is light to moderate brown (5YR 5/6 to 5YR 4/4). Less than 1" slough at top of run. Slightly moist. No hits or staining. Shallowest "bedrock" chunk is at 4.0'.
	RUN 2: 2.5-5.0	2.3	BH10036RM (grab) BH10037RM (VOCs) BH10037RM (VOCs)					3.0		
								4.0		
	4.8	4.8	050897 1030					4.8		NO RECOVERY 4.8-5.0
	5.0	5.0						5.0		
	RUN 3: 5.0-8.0	3.4						6.0		Same as above, w/larger pod of bedrock claystone-like material at 5.2-5.5. 1.5" of slough at top of run. No staining, no hits. Slightly moist. (Bedrock" not broken out as CH because of presence of gravel.)
								7.0		
	8.0	8.0	BLANK					8.0		Same as above. Large bedrock chunk at 8.8'-9.3' (consumed by sample BH10038RMF and BH10038RM), but back to GC below 9.3. Large (>2") gravel clast at 9.3-9.5', excluded from BH10038RM.
	RUN 4: 8.0-11.0	2.7	BH10038RMF (VOCs, SVOCs, RADS) BH10038RM (VOCs)					9.0		
								9.7		TOP OF BEDROCK claystone to claystone w/silt - see p. 2 of 2
								10.0		

Box 1 of 2: 0.0-11.0'

- Delete line across sample column

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 12397
Location - North: _____ East: _____
Date: 050897
Geologist: J Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: IHSS 119.1 Source
Total Depth: 16.0
Company: Tierra Project No.: _____
Sample Type: continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
Box 1 of 2: 0.0-11.0 (empty)								10.0		(claystone to claystone w/silt) - dark yellowish brown (10YR 4/2) to olive gray (5Y 3/2); to olive gray (5Y 4/1) below 14.0'. Slightly moist to almost dry. Cohesive and stiff, 9.7 to 11.0; 11.0-14.0 is very crumbly, moderately friable. Increasing cohesiveness below 14.0', but still less so than 9.7-11.0. Subhorizontal Fe-healed fracture @ 10.1'. Abundant high-angle to vertical fractures @ 12.5-13.9, especially at 13.0-13.8 (consumed by samples BH 10039 RM and BH 10039 RMF). All appear Fe-healed. Occasional fractures below 14.0', increasing @ ~15-15.4' and 15.7-16.0', of varying angles, also Fe-healed. No stains (VOC).
11.0	11.0	11.0								
11.0	11.0	11.0						11.0		
	RUN 5: 11.0-14.0	4.0	BH 10039 RM (VOCs) BH 10039 RMF (VOC screen)					12.0		
Box 2 of 2: 11.0-16.0								13.0		
14.0	14.0	14.0						14.0		
	14.0	14.0								
	RUN 6: 14.0-16.0	3.8						15.0		
16.0	16.0	16.0						16.0		TD = 16.0'

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 1 OF 2

Borehole Number: 12497
Location - North: _____ East: _____
Date: 050997
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: ~~OU1~~ 119.1 Source area
Total Depth: 14.0
Company: Terra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	0.0	0.0				CL	0.0		Silty clay w/sand and gravel – Dark yellowish brown (10YR 4/2) to grayish brown (5YR 3/2). Silt and sand in upper 0.4-0.5'; more clay rich below. Gravel to ~0.75"; subangular to subrounded. Slightly moist. Rooted top. NO VOC staining or hits.
	RUN 1: 0.0-2.5	1.8	BH 100440 RM (soils) BH 100440 RMF (soils)					1.0		
	2.5	2.5	2.5					1.8		NO RECOVERY 1.8-2.5
	2.5	2.5	2.5					2.0		
	RUN 2: 2.5-5.0	3.0	BH 100441 RM (rock) BH 100442 RM (VOC) BH 100442 RMF (VOC screen)					2.5		Same as above. Increasingly hard and stiff w/increasing depth. Trace gravel, mainly <0.5". Slightly moist. No staining or hits (VOC).
	5.0	5.0	5.0					3.0		
	5.0	5.0	5.0					4.0		
	RUN 3: 5.0-8.0	4.0	BH 100443 RM (VOC) BH 100443 RMF (VOC screen)					5.0		Same as above. In 1.0' of slough is nice big smooshed bee. Carbonaceous flecks common at 5.5-6.1. No VOC hits/staining (the carb. flecks appear natural, not like DNAPL or other artificial organics.)
	8.0						CH	6.0		Displaced claystone chunk, 6.1-6.5. See bedrock for description. (Drawn as CH because it's not in-place bedrock.)
							GC	6.5		Gravel-sand-clay mixture – moderate yellowish brown (10YR 5/4) to moderate brown (5YR 3/4). Slightly moist. No VOC hits/staining.
								7.0		TOP OF BEDROCK claystone to claystone w/silt – between moderate yellowish brown (10YR 5/4) and light olive brown (5Y 5/6) w/Fe stains scattered throughout. Slightly moist. No VOC hits or stains. Fe staining dominates color from 9.5-10.1, 8.6-9.2 and in smaller areas throughout intervals to 14.0. Fresh color (light olive gray to olive gray, 5Y 5/2 to 5Y 3/2) ~13.2-13.5 and in smaller zones elsewhere. Subhorizontal Fe-healed fractures 13.7'. Ironstone nodules scattered throughout most of bedrock (except where fresh); caliche clasts
	8.0	8.0	8.0					8.0		
8.4	8.0	8.0	8.0					9.0		
8.4	RUN 4: 8.0'-11.0	4.0'	BH 100444 RM BH 100444 RMF 050997					10.0		

Box 1 of 2: 0.0-8.4'

Box 2 of 2

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 12497
Location - North: _____ East: _____
Date: 050997
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: LHSS 119.1 Source area
Total Depth: 14.0
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
Box 2 of 2: 8.4 - 14.0	SEE P. 1 OF 2							10.0		also present, but rare. Ironstones & caliche clasts to ~1/4 - 3/8 inch diameter. Somewhat malleable until ~~approximately~~ (T&S) 050997 top of fresh interval (~13.2'), where core becomes crumbly, moderately friable. (Ironstone & caliche clasts are indicated in lith. log by I & +, respectively, but exact locations of these clasts and their relative proportion are NOT shown in log: it only shows they are present, not where & how many.)
	11.0	11.0	11.0					11.0		
	11.0 RUN 5: 11.0' 14.0	4.0'	N/A					12.0		
								13.0		
	14.0	14.0	14.0					14.0		TD = 14.0'

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 1 OF 2

Borehole Number: 12597
Location - North: _____ East: _____
Date: 051297
Geologist: J. Boylan
Drilling Equip.: Geoprobe
Surface Elevation: _____
Area: IHSS 119.1 Source area
Total Depth: 17.5'
Company: Tierra — Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	0.0	0.0				SC	0.0		Silt-sand-gravel mixture, rooted trace to some clay. Dark yellowish brown (10YR4/2) increasing clay w/depth. Dry to slmst. Gravel mostly < ½" diameter. Subang-subround.
								0.8		
	RUN 1: 0.0-3.6	3.1	BH 10047 RM (rad.)				CL	1.0		Silty clay w/trace to some sand and gravel – grayish brown (5YR3/2) to dark yellowish brown (10YR4/2). Gravel content decreases w/depth as clay increases. Slightly moist. Hard, stiff below 2.2'. Reworked bedrock below 2.5' (contains traces sand, gravel), looking like intact bedrock except for gravelly layer at ~ 4.6-4.75' (included in VOC & VOC screen samples). This reworked bedrock is between moderate olive brown (5Y4/4) and mod. yellowish brown (10YR5/4). Occasional clasts & pockets of caliche. Below 5.3', back to moderate yellowish brown (10YR5/4) silty clay w/traces gravel & sand. All slightly moist. Occasional gravel clast to >1.5' diameter. NO VOC staining or hits. Note: bedrock broken out as CH (mod. to high plasticity), but gravelly layer @ 4.6-4.75 is not broken out.
			NO RECOV					2.0		
			BH 10047 RM (rad.) CH 10047 RM (VOC) SH 10047 RMF (screen)				CH	2.5		
								3.0		
	3.6	3.6						3.1		
	3.6	3.6						3.6		
	RUN 2: 3.6-5.0	2.1						4.0		
	5.0	5.0	5.0					5.0		
								5.3		
	RUN 3: 5.0-8.0	4.0	N/A				CL	6.0		See above
								7.0		
								8.0		
8.0	8.0	8.0	8.0				GW/GM	8.4		051297 ~~Gravel with sand~~ Sandy gravel with clay and silt – moderate brown (5YR4/4). All clay/silt fraction consumed by samples. Slightly moist (fine). Gravel broken up by Geoprobe, but originally probably subrounded, >2" diam. NO VOC hits or staining.
	RUN 4: 8.0-10.0	1.9	BH 10050 RM (VOC) SH 10050 RMF (VOC screen)					9.0		
								9.4		NO RECOVERY — DELETE PATTERN 9.4-10.0 051297
							DELETE PATTERN	10.0		
10.0	10.0	10.0	10.0							

Box 1 of 2: 0.0 - 8.0

Box 2 of 2

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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ROCKY FLATS PLANT BOREHOLE LOG

PAGE 2 OF 2

Borehole Number: 12597
Location - North: _____ East: _____
Date: 051297
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: UHSS 119.1 source area
Total Depth: 17.5'
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
Box 2 of 2: 8.0-12.5	10.0	10.0	10.0				CL	10.0		silty clay w/ traces sand and gravel — same as above, 5.3-8.4'.
	RUN 5: 10.0-12.5	3.3	BH10057 RM (VOCs) BH10057 RMDup (VOCs) BH10057 RMF (VOC, comm)					10.3		TOP OF BEDROCK @ 051297 claystone to clay stone with silt. Dark yellowish orange (10YR 4/6) due to Fe staining to 11.1'. Below this depth, Fe staining is less frequent, color is light olive gray (5Y 5/2). Slightly moist. Carbonaceous flecks scattered throughout. No VOC staining, but did get VOC hits (to 5ppm, but briefly; more commonly ~0.3-1 ppm). No bedding observed. Darkens below 14.7', with increased Fe oxides; below 16.1', color is between brownish gray (5YR 4/1) and grayish brown (5YR 3/2), and core is almost dry, crumbly, moderately friable. Fe-oxide-healed fracture zones between ~16.0-16.3 and 17.2-17.5'.
	12.5	12.5	12.5					11.0		
	12.5	12.5	12.5					12.0		
	RUN 6: 12.5-15.0'	3.0	N/A					12.5		
	15.0	15.0	15.0					13.0		
	15.0	15.0	19.0					14.0		
	RUN 7: 15.0-17.5	3.8	BH10052 RM (VOCs) BH10052 RMF (VOC, comm)					15.0		
								16.0		
								17.0		
17.5	17.5	17.5	17.5					17.5		TD = 17.5'
								18.0		
								19.0		
								20.0		

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 1 OF 2

Borehole Number: 12697
Location - North: _____ East: _____
Date: 051397
Geologist: d. Baylon
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: IHSS 119.1 Source area
Total Depth: 19.5
Company: Tierra — Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	0.0	0.0				SM	0.0		gravelly, sandy, clayey silt - dusky yellowish brown (10YR 2/2). Dry to slightly moist. Rooted. Gravels to ~0.5". Gradual transition to CL w/depth.
	RUN 1: 0.0' 2.5'	2.3	B141005 3RM (Grab)				CL	0.5		silty clay w/sand and gravel to clay w/silt and traces sand and gravel - dusky yellowish brown (10YR 2/2) to dark yellowish brown (10YR 4/2). Slightly moist (drier in top ~0.3'). Beneath large gravel clast @ 1.2' (gravel >2" diam.), abrupt change to the near-pure clay materid. Silt+er below 2.0', to 3.2', then gradually increasing clay. Occasional caliche pockets below 2.5'. Some intervals may be closer to ML than CL. Hard and stiff below ~2.0'. No VOC hits or stains.
								1.0		
								2.0		
	2.5	2.5	2.5					2.3		NO RECOVERY 2.3-2.5
	2.5	2.5	2.5					3.0		
	RUN 2: 2.5' 5.0'	2.9	B141005 4RM (Grab) B141005 5RM (VOC) B141005 6RM (VOC dup.)					4.0		
	5.0	5.0	5.0					5.0		
	5.0	5.0	5.0					5.4		
	RUN 3: 5.0' 8.0'	3.4	N/A				GM/GC	6.0		Gravel/sand/clay/silt mixture - light brown (5YR 5/6) to moderate brown (5YR 4/4). Slightly moist. Gravels to >2", but average ~0.5". Occasional Fe-oxide-stained zones. Abrupt change to reworked bedrock at 7.7'.
								7.0		
	8.0	8.0	8.0					7.7		
	8.0	8.0	8.0				"CH" but is actually a displaced block of bedrock	8.0		Claystone block (not true bedrock - but, except for top 0.3', which contains a few pebbles, it looks identical to bedrock). Light olive gray (5Y 5/2) to dark yellowish orange (10YR 6/6) where Fe-stained. Slightly moist. Looks just like bedrock, except for 0.4' interval @ 11.7-12.1'. This interval is haphazard mix of chunks of "bedrock" with pockets of dark yellowish brown (10YR 4/2) silty clay with sand and gravel. (All of this interval was consumed in samples.) No VOC hits or staining.
8.0	RUN 4: 8.0' 10.0'	2.8	B141005 8RM (VOC) B141005 9RM (VOC dup.)					9.0		
8.8										
Bot 2 of										
10.0	10.0	10.0	10.0					10.0		

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 2 OF 2

Borehole Number: 12697
Location - North: _____ East: _____
Date: 051397
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: IHSS 119.1 source area
Total Depth: 19.5
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL LITHOLOGIC LOG	SAMPLE DESCRIPTION
10.0	10.0	10.0	10.0				CH	10.0		See previous page
	Run 5: 10.0' 12.5	3.5	BH100S7RM (VOCs) BH100S7RMF (VOCs)					11.0		
	12.5	12.5	12.5				CL	11.7		LAG @ BASE OF SLUMP BLOCK, 11.7-12.1 - see description for 7.7-11.7 for info
	12.5	12.5	12.5					12.0		TOP OF BEDROCK
	Run 6: 12.5' 15.0	4.0	BH100S8RM (VOCs) BH100S8RMF (VOCs screen)					12.1		Claystone to claystone w/ silt - light olive gray (5Y5/2) to dark yellowish orange 10YR (6/6) where Fe-stained. Darkens to almost dark yellowish brown (10YR4/2) or olive gray (5Y3/2) below 14', but does not quite reach these colors. Slightly moist: Chippy, crumbly, moderately friable below about 14.3'. Caliche seams present at about 13.5-13.8'. Fe-healed fractures of various orientations at base of run (~14.7-15.0), consumed by samples. Up to 3 ppm detected @ bottom of Run 6.
	15.0	15.0	15.0	X-ray				13.0		
	15.0	15.0	15.0					14.0		
	Run 7: 15.0' 17.5	1.4	N/A					15.0		
	17.5	17.5	17.5					15.1		NO RECOVERY 15.1 - 17.5 (delete claystone pattern)
	17.5	17.5	17.5					16.0		
	Run 8: 17.5' 19.5	3.4	N/A					17.0		
19.5	19.5	19.5	19.5					17.5		
								18.0		
								19.0		
								19.5		TD = 19.5'
								20.0		

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 1 OF 2

Borehole Number: 14097
Location - North: _____ East: _____
Date: 06/04/97
Geologist: J. Boylan
Drilling Equip.: Geoprobe
Surface Elevation: _____
Area: IHSS 119.1 Source area
Total Depth: 20.0
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	0.0	0.0				SM	0.0		Sand-silt-clay mixture w/ gravel - mottled, but mostly dark yellowish brown (10YR 4/4). Rooted. Slightly moist. No VOC hits.
	RUN 1: 0.0-2.5	1.6	BH100738M (soil)							
							CH	1.0 / 1.2		Reworked bedrock - pale yellow (2.5Y 7/3, 7/4). Slightly moist. No hits. Some Fe-staining.
										Same as above, 0.0-1.0'.
							SM	1.6		NO RECOVERY, 1.6 - ~~2.0~~ 2.5
								2.0		
	2.5	2.5	2.5							
(1) 0.0-8.5	2.5	2.5	2.5					2.5		Clay to silty clay - ~~fine~~ very, dark grayish brown (10YR 3/2). Stiff. Slightly moist. No VOC hits.
	RUN 2: 2.5-5.0	2.9 (incl. 0.3' slough)	BH100744M (soil) BH100758M (VOC)				CL	3.0		
								3.3		Reworked bedrock - mainly olive brown (2.5Y 4/3) w/ Fe staining common. Occasional caliche clasts. No VOC hits. Slightly moist. Lightens w/ increasing depth.
							CH			
								4.0		
								4.6		Sandy silty clay - strong brown (7.5YR 4/6). Slightly moist. No hits. Mottled coloration due to Fe-rich zones.
BOX 1 OF 2	5.0	5.0	5.0				CL	5.0		Silty clay - similar to above, 2.5-3.3 and 4.6-5.0, but more silt than the former and less sand than the latter. Below ~5.4, color is dominantly brown (7.5YR 5/4). Traces gravel, increasing below 7.5; color gradually changes to strong brown (7.5YR 4/6) below 7.5' (>gravel, >groundwater flow, >Fe-oxides.) Slightly moist. No VOC hits. Below 7.5, it's sandy, silty, gravelly clay.
	5.0	5.0	5.0							
	RUN 3: 5.0-8.0	4.0 (incl. 0.3' slough)	N/A							
								6.0		
								7.0		
	8.0	8.0	8.0					8.0		Same as above, 7.5-8.0.
	8.0	8.0	8.0					8.3		~~Top of bedrock~~ Reworked bedrock (insert CH symbol)
8.5	8.5						CH			Claystone to claystone f/ silt - pale olive (5Y 6/3) to light olive brown (2.5Y 5/3) Fe-staining common. Occasional scattered carbonaceous flecks. Slightly moist. No VOC hits.
see p. 2	RUN 4: 8.0-10.0	2.7 (incl. 0.7' slough)	BH100776M (VOC)					9.0		
	10.0	10.0	10.0					10.0		← Replace symbol w/ CH symbol

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

(4011-930-0134-930)(Form GT.1A)(03/01/92)

ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 14097
Location - North: _____ East: _____
Date: 060497
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: IHSS 119.1 Source
Total Depth: 20.0
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/LITHOLOGIC LOG	SAMPLE DESCRIPTION
8.5	10.0	10.0	10.0				CH	10.0		Reworked bedrock – same as above, 8.3-10.0'.
							CL	10.5		Silty clay with sand, trace gravel – strong brown (7.5 YR 5/6, 4/6). Slightly moist. No VOC hits.
Box 2 of 3: 8.5-15.0	Run 5: 10.0-13.0	4.0 (incl. 1.0' slough)	2				GC	11.4		Sandy, clayey gravel w/ silt – mostly fractured gravels, rock flour. Matrix is brown (7.5YR 4/4). ~~Most of matrix below 12.4'~~ (BAR)
	13.0	13.0	13.0				CH	12.7		Reworked bedrock – same as above, 8.3-10.0.
	13.0	13.0	13.0					13.0		Same as above, 12.7-13.0.
	Run 6: 13.0-15.0	3.0 (incl. 1.0' slough)	BH 14077RM (voc)				SC	13.9 14.0		Sand-silt-clay mixture w/ gravel – brown (7.5 YR 4/4). Slightly moist. No VOC hits. Increasing gravel at 15.0', where only fractured gravels and cut gravel discs were recovered.
15.0	15.0	15.0	15.0							
15.0	15.0	15.0	15.0				GC/GR	15.0		Same as above, 13.9-15.0, but with more gravel. ~~Gradual transition from 15.0~~ (BAR)
Box 3 of 3: 15.0-20.0	Run 7: 15.0-18.0	3.9' (incl. 1.0' slough)	BH 14078RM (voc)					16.0		
								16.3		Claystone – light brownish gray (2.5Y 6/2) to light olive brown (2.5 Y 5/3), w/ Fe staining common, ~~especially~~ at 16.9-17.0. At 17.1 and below, color is dark gray, 10 YR 4/1. Boundary between colors is sharp. Fe staining in darker material appears as replacement for leaf/plant debris; some carbonized remains also present. Slightly moist. No VOC hits. Chippy, friable below 17.1'.
	18.0	18.0	18.0					17.0		
	18.0	18.0	18.0					17.9		
	Run 8: 18.0-20.0	2.0' (incl. 1.4' slough)	N/A					18.0		(18.0-20.0) Same as above, 16.3-~~18.0~~ 17.9 (TAR), ~~co~~ 10- of material.
								19.0		Same as below 17.1'. [NOTE: NO RECOVERY 17.9-18.0] Additional Fe-staining at 18.5', 19.4' (thin zones), with Fe-coated dome-like structure @ 19.8' (incipient concretion?). No VOC hits.
20.0	20.0	20.0	20.0					20.0		

TD = 20.0'

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 1 OF 3

Borehole Number: 13997
Location - North: _____ East: _____
Date: 060597
Geologist: J. Beylan
Drilling Equip.: Geoprobe
Surface Elevation: _____
Area: IHSS 119.1 Source
Total Depth: 22.0'
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	0.0	0.0				CL	0.0		Silty sandy clay – consumed for VOC sample. 35 ppm PID. Sl. moist.
	RUN 1:						SM	0.2		Silt-sand mixture w/ clay and gravel. – dark grayish brown (10YR 4/2). Dry to sl. moist. No VOC hits (or swamped by surrounding material).
	0.0-2.5	2.5	BH 100079 RM (Grab) BH 100080 RM (VOC) BH 100080 RM (VOC)					0.8		
	2.5						CL	1.0		Clay to silty clay – very dark grayish brown (10YR 3/2). Slightly moist. To 35 ppm PID. Siltier, w/ some vfg sand, @ base of 2.5-4.0 material.
	2.5	2.5	2.5					2.0		
	2.5	2.5	2.5					2.5		Same as above, 0.8-2.5', but color is dark brown (10YR 3/3). No VOC hits. Increasing silt as noted above (last 1.0 – 3.5').
	RUN 2: 2.5-5.0	3.0 (incl. 0.2' slough)	BH 100081 RM (Grab) BH 100082 RM (VOC)					3.0		
	5.0	5.0	5.0					4.0		
	5.0	5.0					ML			Sand-silt clay mixture – brown to strong brown (7.5YR 4/4 to 7.5YR 4/6), mottled and streaked. No VOC hits. Slightly moist. Fe-staining causes streaking.
BOX 1 OF 3 : 0.0-8.2	RUN 3: 5.0-8.0	3.7 (incl. 0.4' slough)	N/A					5.0		Same as above, 4.0-5.0. Color ~~7.5YR 4/4~~ same as above and to ~~dark~~ yellowish brown, 10YR 5/4); still streaked and mottled w/ Fe stains. No VOC hits.
								6.0		
								7.0		
	8.0	8.0	8.0				GC/GM	7.7		Gravel-sand-silt-clay mixture – strong brown (7.5YR 4/6). Slightly moist No VOC hits. Gravels mainly fractured fragments.
8.2	8.0	8.0	8.0					8.0		
8.2	RUN 4: 8.0-10.0	2.7 (incl. 0.4' slough)	BH 100083 RM (VOC)							Same as above 7.7-8.0, w/ increased fine (sand-silt-clay) fraction. Color mottled, w/ some light yellowish brown (2.5Y 6/3, 6/4). No VOC hits.
set next page							CH	8.8		Reworked bedrock. Sl. moist. No VOC hits.
						dup	CL	9.0		Same as above, 4.0-7.7, w/ increased clay. Slightly moist. No VOC hits. Enough clay to make it CL.
	10.0	10.0	10.0					10.2		← change pattern to (CL)

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 13997
Location - North: _____ East: _____
Date: 060597
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: IHSS 119.1 source
Total Depth: 22.0'
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR
APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL LITHOLOGIC LOG	SAMPLE DESCRIPTION
8.2	10.0	10.0	10.0				CL	10.0		Same as above, 9.0-10.0'. Gravel rare, but present. Gravel content increases below 12.7'. Slightly moist. No VOC hits.
	RUN 5: 10.0-13.0	4.0 Ind. 0.7' slough	N/A					11.0		← Change pattern to CL,
BOX 2 OF 3: 8.2 - 16.9								12.0		
	13.0	13.0	13.0					12.8		Clay-sand-gravel-silt mixture, same as 7.7-8.0 but more clay.
	13.0	13.0	13.0				CC	13.0		Same as above, 12.8-13.0'. Slightly moist. No VOC hits. Lowermost material is moist, but no free liquid.
	RUN 6: 13.0-15.0	2.2 Ind. 0.9' slough	BH 100815 RM (100% recovery) (100% fractured)					14.0		
								14.3		NO RECOVERY 14.3-15.0
	15.0	15.0	15.0					15.0		Same as above, 12.8-14.3
	15.0	15.0	15.0					15.1		Top of bedrock (diagonal contact, 15.0 to 15.3) Claystone - light brownish gray (2.5 Y 6/2) to light olive brown (2.5 Y 5/3). Fe-staining common. Contact consumed by sample, somewhat malleable. 15.1-15.7' below this it is crumbly, more friable. VOC hits to 100 ppm @ contact to 400 ppm in upper crumbly material; sampled contact and 15.7-16.3'. Slightly moist. Color to dark gray (10 Y R 4/1). Increasing silt below 17.3'. Traces sand (in tan rip-up clasts) below 17.8'.
	RUN 7: 15.0-18.0	4.0 Ind. 0.5' slough	BH 100815 RM (100% recovery) BH 100816 RM (100% in bit) BH 100816 RM (VOC remainder)					16.0		
16.9								17.0		
16.9								17.3		
BOX 3 OF 3: 16.9 - 22.0'	18.0	18.0	18.0					18.0		clayey siltstone - trace v.f.g. sand - grayish brown (2.5 Y 5/2). Occasional Fe stains along fractures. Fractures are high angle, appear concentrated around 18.3-18.7'. Fe also present as replacement of organic debris (rare). Transitional upper and lower contacts. Slightly moist to dry. No VOC hits.
	18.0	18.0	18.0					19.0		
	RUN 8: 18.0-20.0	4.0 (Ind. 1.2' slough)	N/A					19.2		Siltstone - Fe-stained @ top 0.2'. Dark gray (5 Y 4/1). Ironstone concretions also present though rare. Slightly moist. No hits except -19.6' (to 1 ppm max).
22.0	20.0	20.0	20.0					20.0		

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

060597

060697

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 13997
Location - North: _____ East: _____
Date: 060697
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: IHSS 119.1 Source
Total Depth: 22.0
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL LITHOLOGIC LOG	SAMPLE DESCRIPTION
↑ 16.9 RUN 3: Box 3 of 3 16.9-22.0' 22.0	20.0 RUN 3: 20.0-22.0 22.0	20.0 3.3 Lithology 1.3 stayed 22.0	20.0 BH 13997 RM (top) BH 13997 RM (bottom) (UC seen) 22.0	1 1 1 1 22.0				20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0	I I	Same as above, 19.2-20.0. Heavy Fe-staining in some zones. Most Fe as fracture fill. Most fractures ~~of RUN~~ are high-angle, to vertical; one @ shows slickensides. Other Fe as ?rootstone, with calcite and Mn, as at 20.1 and 21.1'. Slightly moist. VOC hits: to 16 ppm FID, 15 ppm PID; highest in sampled material (21.2-21.8'). Color is mottled due to Fe staining, w/overall color light olive brown (2.5Y 5/3) to dark grayish brown (2.5Y 4/2). TD = 22.0'

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 13897
Location - North: _____ East: _____
Date: 06/09/97
Geologist: J. Boylan
Drilling Equip.: Geoprobe
Surface Elevation: _____
Area: 111SS 119.1 Source
Total Depth: 20.0'
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	0.0	0.0				CL	0.0		Clay to silty clay — brown (10YR 4/3) to very dark grayish brown (10YR 3/2). Lighter color in top 0.2', darker below. Top 0.6' is relatively loose, crumbly, whereas below this it's hard, stiff. More silt in top 0.6', w/trace to some sand also present. Moist in top 0.2' due to several days of rains; below this, slightly moist. No VOC hits. Rooted @ top. Occasional trace gravel. Occasional caliche clast.
	RUN 1: 0.0-2.5	2.3	BH 10088 RM (rad's)					1.0		
								2.0		
	2.5	2.5	2.5					2.3		NO RECOVERY, 2.3-2.5
	2.5	2.5	2.5					2.5		Same as above, 0.0-2.3; increasing silt w/depth, trace to some vfg sand also present. Color grades to yellowish brown (10YR 5/6) w/depth (ie., below 3.8-4.0'). VOC detections to 1 ppm.
	RUN 2: 2.5-5.0	2.9	BH 10089 RM (rad's) BH 10090 RM (VOC's)					3.0		
								4.0		
	5.0	5.0	5.0				SC/GM	4.5		Gravel-sand-silt-clay mixture — brown (7.5YR 4/4). Slightly moist. Gravels to >1.5". Some gravel fragments rock flour. No VOC hits.
	5.0	5.0	5.0					5.0		Same as above, 4.5-5.0'. Most of recovery from 5.2'-6.3' is composed of broken, fractured, and cut gravel fragments, w/very little matrix. No VOC hits.
	RUN 3: 5.0-8.0	1.5'	N/A					6.0		
								6.4		NO RECOVERY 6.4-8.0'
	8.0	8.2	8.0					7.0		
	8.0	8.0	8.0					8.0		Same as above, 4.5-5.0', more sand-silt-clay than in most of the 5.0-6.4' interval. No VOC hits.
	RUN 4: 8.0-10.0	2.5 (incl. 0.4' slough)	BH 10091 RM (VOC's)					9.0		TOP OF BEDROCK (see note @ 11', page 2) Claystone — light brownish gray (2.5Y 6/2) to olive yellow or brownish yellow (2.5Y 6/6 or 10YR 6/6) where Fe-stained, as in top 0.5'. Slightly moist. Gravels, sands pushed in from above. No VOC hits. Bottom portion covered by sample
	10.0	10.0	10.0					10.0		

BOX 1 OF 2 : 0.0 - 10.4'

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: 13897
Location - North: _____ East: _____
Date: 06/10/97
Geologist: J. Beylan
Drilling Equip.: Geoprobe
Surface Elevation: _____
Area: IHSS 119.1 Source
Total Depth: 20.0'
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR
APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/LITHOLOGIC LOG	SAMPLE DESCRIPTION
see p.1 10.4	10.0	10.0	10.0					10.0		
	RUN 5: 10.0-13.0'	3.2 (incl. 0.6 slough)	N/A				SEE → NOTE	11.0		Same as above 9.0-10.0'. Color dominantly light yellowish brown (2.5Y 6/3) to light brownish gray (2.5Y 6/2), w/Fe staining rare except in lowest 0.3' of recovery (12.3-12.6'), which is heavily stained, moist.
								12.0		NOTE: single pebble, apparently in-place, @11.3', makes this look like reworked bedrock. However, no other "in-place" pebbles present in any other runs, although much of core looks like slough due to saturated, semi-liquid consistency. Bedrock pick is therefore NOT positive: may have reworked bedrock over intact bedrock, or intervening materials may not have been recovered.
	13.0	13.0	13.0					12.6		NO RECOVERY 12.6-13.0
	13.0	13.0	13.0					13.0		Same as above 9.0-10.0', w/colors of 12.3-12.6' in streaks. Saturated. No VOC hits. Dominant color:
	RUN 6: 13.0-15.0	0.9' (incl. 0.3' slough)	BH1009 2RM (VOC)					13.6		light olive brown (2.5Y 5/3). Soft, squishy - not intact.
								14.0		NO RECOVERY 13.6-15.0
	15.0	15.0	15.0					15.0		
	15.0	15.0	15.0							Same as above 9.0-10.0', more similar to 13.0-13.6' w/more Fe staining. Saturated. No VOC hits. Very soft, squishy; core completely disfigured during extraction from liner; is now mainly smeared chunks of mud.
	RUN 7: 15.0-17.0	1.4 (incl. 0.4' slough)	N/A					16.0		NO RECOVERY 16.0-17.0
	17.0	17.0	17.0					17.0		
	17.0	17.0	17.0							Same as above 9.0-10.0. Material from 18.3-19.3 is firm intact core; balance is saturated, squishy, semi-intact. Intact portion includes dark gray zone (10YR 4/1), 18.3-18.8', and olive brown (2.5Y 4/3) below 18.8' (18.7-19.0' was consumed by sample.) Fe-healed near vertical fracture, 18.9-19.3', as well as other Fe-healed fractures. No VOC hits. Intact portion is slightly moist; crumbly below ~19.0'.
	RUN 8: 17.0-20.0	2.7' (incl. 0.4' slough)	BH1009 3RM (VOC)					18.0		
								19.0		
								19.3		NO RECOVERY 19.3-20.0
20.0	20.0	20.0	20.0	20.0				20.0		

BOX 2 of 2: 10.4-20.0

TD = 20.0'.

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 1 OF 2

Borehole Number: 14197
Location - North: _____ East: _____
Date: 061197
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: IHSS 119.1 Source
Total Depth: 18.0'
Company: Tierra Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR
APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	0.0	0.0				OL	0.0		Organic silty sandy clay - dark brown (10YR 3/3) heavily rooted. No VOC hits. Slightly moist. Gravel lens @ base
	RUN 1: 0.0-2.5	2.3	BH 10099 Rem (radial)				SM	0.4		silt-sand mixture w/clay and gravel - dark brown (10YR 3/3). Dry to slightly moist. No VOC hits. Gravel lens separates this interval from overlying material.
								1.0		
							CL	1.3		clay to silty clay with trace to some sand and gravel - brown to dark brown (10YR 4/3, 3/3). Occasional gravel clasts. Slightly moist. No VOC hits.
								2.0		
2.5	2.5	2.5	2.5					2.3		NO RECOVERY 2.3-2.5
2.5	2.5	2.5	2.5					2.5		Same as above 1.3-2.3'. No VOC hits. Color grades to strong brown (7.5YR 4/6) w/depth.
	RUN 2: 2.5-5.0	2.9 (ind. 0.1' slough)	BH 10093 Rem (radial) BH 10096 Rem (vert.) BH 10097 Rem (vert.)					3.0		
								4.0		
5.0	5.0	5.0	5.0					5.0		Same as above 1.3-2.3. Increased gravel and sand; gravel lens @ 5.3', 7.4'. ~~Color grades from strong brown @ top (7.5YR 4/6) to~~ 061197
5.0	5.0	5.0	5.0					6.0		
	RUN 3: 5.0-8.0	2.8 (ind. 0.2' slough)	N/A					7.0		
							GC/GM	7.4		Gravel-sand-silt-clay mixture - matrix is mottled, ranging from strong brown (7.5YR 4/6) and (7.5YR 5/6) to light olive brown (2.5Y 5/4) to brown (7.5YR 4/4). Color variation due in part to presence of various rotting gravels. Much rock flour pulverized and fractured gravels. No VOC hits. Slightly moist to moist.
8.0	8.0	8.0	8.0					7.6		NO RECOVERY 7.6-8.0
8.0	8.0	8.0	8.0					8.0		
	RUN 4: 8.0-10.0	2.0' ind. 0.2' slough	BH 10098 Rem (vert.)					9.0		
10.0	10.0	10.0	10.0					9.8		NO RECOVERY 9.8-10.0
								10.0		

Box 1 of 2 : 0.0 - 10.0'

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 2 OF 2

Borehole Number: 14197
Location - North: _____ East: _____
Date: 061197
Geologist: J. Boylan
Drilling Equip.: Geoprobe

Surface Elevation: _____
Area: IHSS 119.1 Source
Total Depth: 18.0'
Company: Tierra — Project No.: _____
Sample Type: Continuous core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL LITHOLOGIC LOG	SAMPLE DESCRIPTION
10.0	10.0	10.0	10.0					10.0		Same as above, 7.4-10.0'. Moist.
	RUN 5: 10.0-13.0	1.6 (ind. 0.2' slough)	BH 10009 RFM (VOCs)					10.2		TOP OF BEDROCK Claystone — light olive brown (to 2.5Y5/4) to light brownish gray (2.5Y 6/2). Slightly moist, malleable. No VOC hits. Fe-staining common.
								11.0		
								11.4		NO RECOVERY 11.4-13.0'
								12.0		
13.0	13.0	13.0	13.0					13.0		
	13.0	13.0	13.0							Same as above, 10.9-11.4'. Color now light brownish gray to grayish brown (2.5Y 6/2 to 2.5Y 5/2). Fe-staining common. No VOC hits.
	RUN 6: 13.0-15.0	2.0 (ind. 1.0' slough)	BH 10100RM (VOCs)					14.0		NO RECOVERY 14.0-15.0'
15.0	15.0	15.0	15.0					15.0		
	15.0	15.0	15.0							Same as above, 10.9-11.4'. Increasingly crumbly, friable w/ depth, and decreasingly malleable. Increasing silt w/ depth. Color mottled browns, grays, dominantly olive brown (2.5Y 4/3) to grayish brown (2.5Y 5/2). Slightly moist. Fe stained streaks common.
	RUN 7: 15.0-18.0	4.0' (ind. 1.0' slough)	N/A	VF				16.0		
								16.4		clayey, sandy siltstone — grayish brown (2.5Y 5/2) to light gray (2.5Y 7/2, 10YR 7/1). Decreasing clay, increasing sand w/ depth. Sand is vfg. Fe-healed fractures common @ top and towards base (16.4-16.7', 17.2-17.5'): Shallower angle @ upper, higher angle @ lower intervals noted. Dry to slightly moist. No VOC hits.
				VI				17.0		
18.0	18.0	18.0	18.0					18.0		Core damaged, especially towards base of run.
				18.0						TD = 18.0'
								19.0		
								20.0		

BOX 2 OF 2: 10.0-18.0'

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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Appendix B
SW 846 Method 8260A Analyte List

SW 846 Method 8260A Analyte List

Chloromethane
Vinyl Chloride
Bromomethane
Chloroethane
1,1-Dichloroethene
Acetone
Carbon disulfide
Methylene chloride
trans-1,2-Dichloroethene
1,1-Dichloroethane
cis-1,2-Dichloroethene
2-Butanone
Chloroform
1,1,1-Trichloroethane
Carbon tetrachloride
Benzene
1,2-Dichloroethane
Trichloroethene
1,2-Dichloroproane
Bromodichloromethane
cis-1,2-Dichloropropene
4-Methyl-2-pentanone
Toluene
trans-1,2-Dichloropropene
1,1,2-Trichloroethane
Tetrachloroethene
2-Hexanone
Chlorodibromomethane
Chlorobenzene
Ethylbenzene
m,p-Xylene
o-Xylene
Styrene
Bromoform
1,1,2,2-Tetrachloroethane
1,3-Dichlorobenzene
1,4-Dichlorobenzene
1,2-Dichlorobenzene

Appendix C
Analytical Results - Downgradient Investigation

Analytical Results - IHSS 119.1 - Downgradient Investigation

Location	Sample	Unit	Depth	2-Butanone	Acetone	1,1-DCA	1,1,1-TCA	Methylene Chloride	PCE	TCE	2-Hexanone	Chloro-methane	Hexane	Cyclo-butanol	Silanol trimethyl-	Un-known	Comments
Downgradient Locations																	
12797	BH10062RM	ug/kg	9.25 - 9.5	360 J	210 J	nd	nd	nd	nd	nd	<1200	<1200	860 J				
12897	BH10059RM	ug/kg	4.1 - 4.5	250 J	510 JB	nd	nd	nd	nd	nd	<1200	<1200					1.5 ppm PID/FID hit
12897	BH10060RM	ug/kg	12 - 12.3	190 J	450 JB	nd	nd	nd	nd	nd	<1200	<1200					
12897	BH10061RM	ug/kg	13 - 13.4	170 J	280 JB	nd	nd	nd	nd	nd	<1200	<1200					6 ppm PID/FID hit
12997	BH10063RM	ug/kg	7.85 - 8.1	240 J	<1200	nd	nd	nd	nd	nd	<1200	<1200	720 J				
13097	BH10064RM	ug/kg	11 - 11.4	330 J	240 J	nd	nd	nd	nd	nd	<1200	<1200	700 J				1 ppm PID/FID hit
13197	BH10071RM	ug/kg	11.5-12	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					
13197	BH10072RM	ug/l		<1200	5.7 J	nd	nd	nd	nd	nd	<1200	7.2 J					Rinsate
13297	BH10066RM	ug/kg	11.2-11.6	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					
13397	BH10065RM	ug/kg	15.3-15.8	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					
13497	BH10070RM	ug/kg	18-18.3	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					
13597	BH10069RM	ug/kg	15.0-15.8	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					
13597	H10069RM DU	ug/kg	15.8-16.5	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					
13697	BH10067RM	ug/kg	15.5-15.8	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					
13797	BH10068RM	ug/kg	13.0-13.4	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					

nd = not detected at detection limit of 620 ppb
J = result below detection limit

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Appendix D
Analytical Results - Implementation Investigation

Analytical Results - IHSS 119.1- Implementation Investigation

Location	Sample	Unit	Depth	2-Butanone	Acetone	1,1-DCA	1,1,1-TCA	Methylene Chloride	PCE	TCE	2-Hexanone	Chloro-methane	Hexane	Cyclo-butanol	Silanol trimethyl-	Un-known	Comments
Original 6 Locations within IHSS 119.1																	
12197	BH10028RM	ug/kg	4.3-4.6	250 J	320 J	nd	nd	180 J	nd	nd	<1200	<1200				730 JB	
12197	BH10029RM	ug/kg	5.0-5.6	410 J	1100 J	nd	nd	280 J	nd	nd	140 J	<1200					
12297	BH10032RM	ug/kg	4.25-4.5	170 J	500 J	nd	nd	260 J	nd	nd	<1200	<1200				740 JB	
12297	BH10033RM	ug/kg	6.75-7.0	230 J	380 J	nd	nd	240 J	nd	nd	<1200	<1200					
12297	BH10034RM	ug/kg	10.25-10.8	140 J	370 J	nd	nd	290 J	nd	nd	<1200	<1200					
12397	BH10037RM	ug/kg	4.4-4.8	240 J	380 J	nd	nd	260 J	160 J	nd	<1200	<1200					
12397	BH10038RM	ug/kg	9.2-9.7	220 J	460 J	nd	nd	240 J	nd	nd	<1200	<1200					
12397	BH10039RM	ug/kg	13.0-13.4	240 J	400 J	nd	nd	210 J	nd	nd	<1200	<1200					
12497	BH10042RM	ug/kg	4.75-5.0	210 J	<1200	nd	nd	200 J	nd	nd	<1200	<1200					
12497	BH10043RM	ug/kg	6.5-6.8	230 J	380 J	nd	nd	230 J	nd	nd	<1200	<1200		860 J			
12497	BH10044RM	ug/kg	8.9-9.2	270 J	570 J	nd	nd	240 J	nd	nd	<1200	<1200					
12597	BH10045RM	ug/l		<1200	<1200	nd	nd	nd	nd	nd	<1200	6.9 J			16 J		Rinsate
12597	BH10049RM	ug/kg	4.7-5.0	280 J	360 JB	nd	nd	nd	nd	nd	<1200	<1200					
12597	BH10050RM	ug/kg	8.7-9.4	250 J	330 JB	nd	nd	nd	nd	nd	<1200	<1200					
12597	BH10051RM	ug/kg	10.0-10.3	200 J	290 JB	nd	nd	nd	nd	nd	<1200	<1200					5 ppm PID/FID hit
12597	BH10051RM DUP	ug/kg	10.3-10.6	170 J	350 JB	nd	nd	nd	nd	nd	<1200	<1200					
12597	BH10052RM	ug/kg	15.7-16.1	240 J	310 JB	nd	nd	nd	nd	nd	<1200	<1200					
12697	BH10055RM	ug/kg	4.7-5.0	220 J	500 J	nd	nd	nd	nd	nd	<1200	<1200					
12697	BH10056RM	ug/kg	9.4-9.6	200 J	540 J	nd	nd	nd	nd	nd	<1200	<1200					
12697	BH10057RM	ug/kg	11.6-11.9	190 J	440 J	nd	nd	nd	nd	nd	<1200	<1200					
12697	BH10058RM	ug/kg	14.7-15.0	220 J	330 J	nd	nd	nd	nd	nd	<1200	<1200					3 ppm PID/FID hit
Final 4 Locations within IHSS 119.1																	
14097	BH10075RM	ug/kg	4.6-4.8	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					
14097	BH10076RM	ug/kg	8.0-8.3	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					
14097	BH10077RM	ug/kg	14.7-15.0	<1200	1000 J	nd	nd	nd	nd	nd	<1200	<1200					
14097	BH10078RM	ug/kg	16.0 - 16.4	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					
13997	BH10080RM	ug/kg	.1 & 1.8	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					35 ppm PID/FID
13997	BH10082RM	ug/kg	4.7-5.0	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					
13997	BH10083RM	ug/kg	9.6-9.9	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					
13997	BH10084RM	ug/kg	13.9 - 14.3	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					
13997	BH10085RM	ug/kg	15-15.3	<1200	<1200	170 J	160 J	nd	270 J	340 J	<1200	<1200					100 ppm PID/FID
13997	BH10086RM	ug/kg	15.7-16.3	<1200	<1200	230 J	280 J	nd	**660**	550 J	<1200	<1200					400 ppm PID/FID
13997	BH10087RM	ug/kg	21.2 - 21.5	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					15 ppm PID/16 ppm FID
13897	BH10090RM	ug/kg	4.6 - 4.9	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					1 ppm PID/FID
13897	BH10091RM	ug/kg	9.7 - 10.0	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					
13897	BH10092RM	ug/kg	13.3 - 13.6	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					
13897	BH10093RM	ug/kg	18.7 - 19.0	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					
14197	BH10096RM	ug/kg	4.7 -5.0	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					
14197	BH10096RM DUP	ug/kg	4.4 - 4.7	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					
14197	BH10097RM	ug/l		<1200	<1200	nd	nd	nd	nd	nd	<1200	1.5 J					Rinsate
14197	BH10098RM	ug/kg	9.4-9.8	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					
14197	BH10099RM	ug/kg	10.6 - 11.0	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					
14197	BH10100RM	ug/kg	13.5 - 13.8	<1200	<1200	nd	nd	nd	nd	nd	<1200	<1200					

nd = not detected at detection limit of 620 ppb
J = result below detection limit

Appendix E
Agency Concurrence

cc: Annette P.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
999 18th STREET - SUITE 500
DENVER, COLORADO 80202-2466

JUL - 7 1997

Ref: 8EPR-F

Mr. Steve Slaten
Department of Energy
Rocky Flats Office
P.O. Box 928
Golden, CO 80402-0928

Re: OU 1 Investigation and Record of Decision

Dear Mr. Slaten:

EPA has reviewed the analytical results of the subsurface soils investigation of IHSS 119.1 in Operable Unit 1. Of the 51 samples taken, only one exceeded the detection limit and none exceeded the subsurface soil action levels for the VOCs of concern. These samples were taken from soils that are directly adjacent to wells which have shown the highest concentration of contaminants, as well as in down gradient areas where the contaminants would have most likely migrated. Since this investigation did not detect any soils that exceeded the action levels, there does not appear to be a contaminant source in the soils that would warrant excavation and treatment as was planned in the OU 1 ROD. Therefore, EPA concurs with the proposal to amend the OU 1 CAD/ROD to reflect this change, and expects to review the draft amendment by September 30, 1997.

The ROD also calls for extraction and treatment of contaminated groundwater from this area and therefore, operation of the collection well should be continued as well as treatment of the collected water. Although the ROD does allow for decommissioning the French Drain and discontinuing its use, it was intended that this occur only after both the source in the soils and the contaminated groundwater were removed. It would be prudent to retain the integrity of the French Drain until D&D of the Industrial Area has been completed. EPA recommends that water from the French Drain itself be sampled but not collected as long as it is shown that no contaminants are present that exceed action levels. The water levels in the French Drain should also be monitored in order to assess the potential for slumping to occur on the hillside.

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If you have any comments or questions, please contact Gary Kleeman at 312-6246.

Sincerely,

Jim Rehder

Tim Rehder, Manager
Rocky Flats Project

cc: Norma Castenada DOE
Carl Spreng, CDPHE
Mary Harlow, Westminster
Kathy Schnoor, Broomfield

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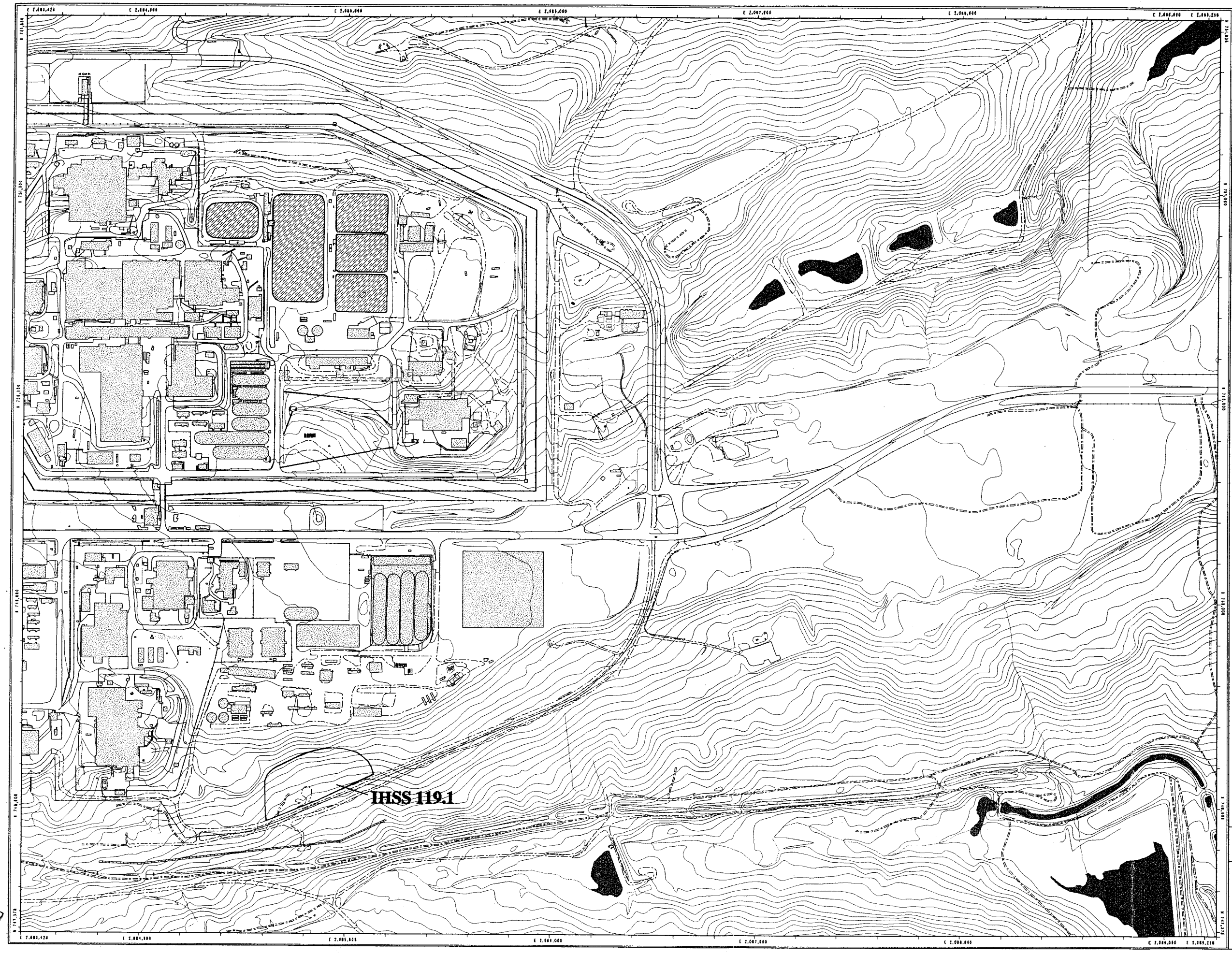
IHSS 119.1
Location Map

Figure 1-1



EXPLANATION

- 5-ft Elevation Contours
- IHSS 119.1
- French Drain GW Recovery System

Standard Map Features

- Buildings or other structures
- Solar evaporation ponds
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences and other barriers
- Paved roads
- Dirt roads

DATA SOURCE:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSI, Las Vegas.
Digitized from the orthophotographs, 1/96

Scale = 1 : 5430
1 inch represents approximately 453 feet

100 0 200 400 ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:

RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: 97-0093 July 29, 1997

igis\projects\hp97\97-0093\sap-ih1.mxd

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IHSS 119.1 Downgradient Sampling Locations

Figure 2-1

EXPLANATION

- Borehole Locations
- Groundwater Wells
- Head Space Survey Boreholes
- Geoprobe Locations
- French Drain System
- Surface Elevation Contours (2 foot)
- Individual Hazardous Substance Sites
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences
- Paved roads
- Dirt roads

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. - 1991.
Hydrology provided by USGS - (date unknown)
Ground Water data provided by RMRS/Hydrogeology, - 1995.
Borehole Sampling locations provided by Geosciences.

Axis of Paleochannel

French Drain

S. Interceptor Ditch

Scale = 1 : 580
1 inch represents approximately 48 feet

15 0 30 60 ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RMRS
Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: 97-0129 July 03, 1997

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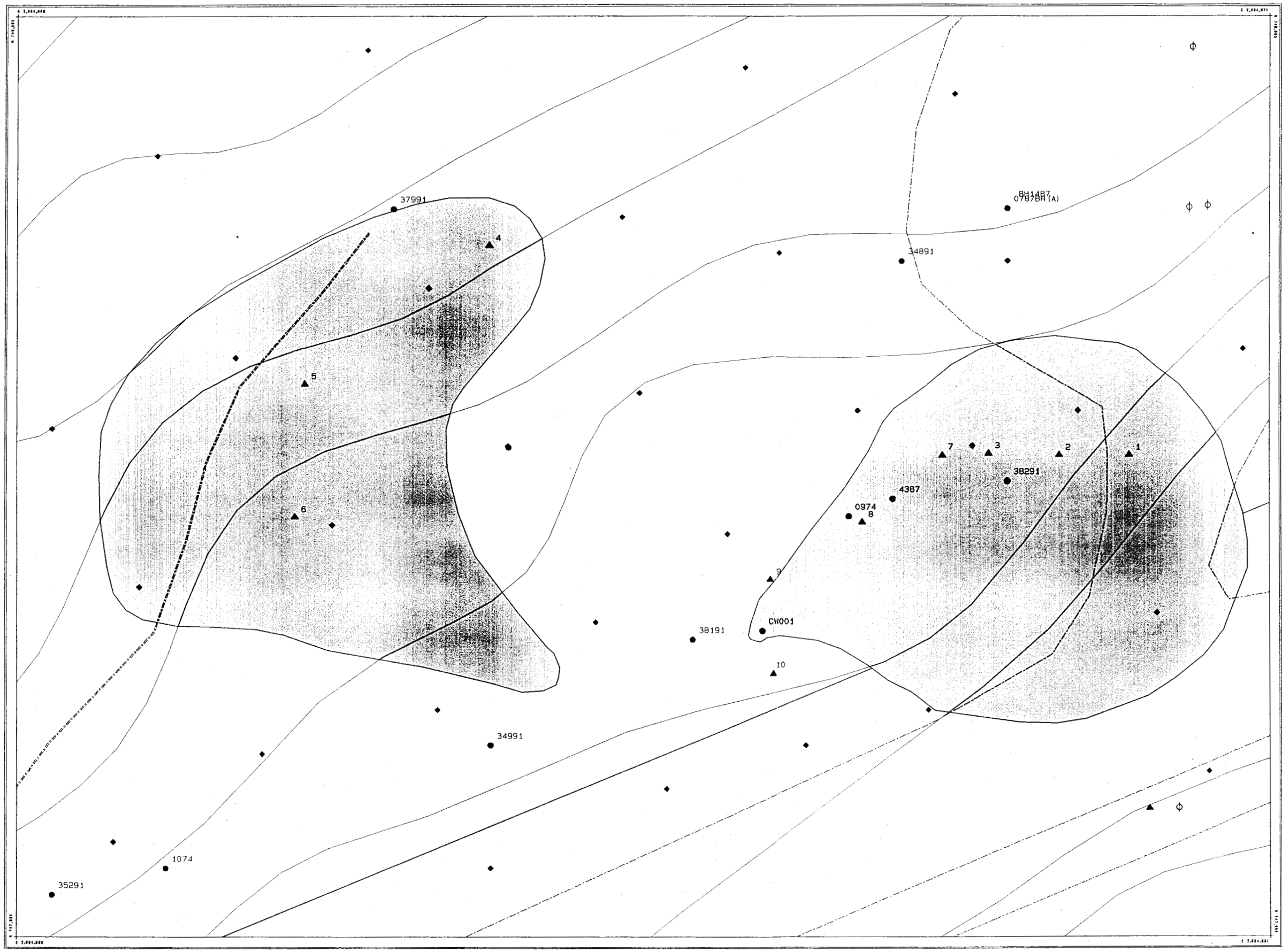
12



Implementation Sampling Locations IHSS 119.1

Figure 3-1

EXPLANATION

- Surface elevation contour
- IHSS Boundary
- Extent of > 20 ppm Headspace Concentration in Soil
- Groundwater Monitoring Well and Collection Well CW001
- Boreholes
- Headspace (1996) Geoprobe Borehole
- 1997 Geoprobe Borehole
- Electric Power Pole

Standard Map Features

- Fences
- Rocky Flats boundary
- Paved roads
- Dirt roads

DATA SOURCE:
Buildings, roads, and fences provided by Fluor/Daniel Engr., EG&G Rocky Flats, Inc. - 1995.
Hydrology provided by USGS - Date unknown)

Scale = 1 : 140
1 inch represents approximately 12 feet

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: 97-0129 July 30, 1997

/gist/projects/fy97/97-0129/fig3-1.aml