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SAMPLING AND ANALYSIS PLAN FOR SITE ASSESSMENT DURING THE
CLOSURE OR REPLACEMENT OF NONRADIOACTIVE UNDERGROUND STORAGE TANKS

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DURING THE CLOSURE OR REPLACEMENT OF
NONRADIOACTIVE UNDERGROUND STORAGE TANKS

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ABSTRACT

The Tank Management Program is responsible for closure or replacement of nonradioactive underground storage tanks throughout the Idaho National Engineering Laboratory (INEL). A Sampling and Analysis Plan (SAP) has been developed that complies with EPA regulations and with INEL Tank Removal Procedures for sampling activities associated with site assessment during these closure or replacement activities. The SAP will ensure that all data are valid, and it also will function as a Quality Assurance Project Plan.

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ACRONYMS

ANL-W	Argonne National Laboratory-West
ARA	Auxiliary Reactor Area
ARDC	Administrative Records and Document Control
BTEX	Benzene, toluene, ethylbenzene, and xylene
CCS	Contract compliance screening
CFA	Central Facilities Area
COC	Chain-of-custody
COCA	Consent Order and Compliance Agreement
DCQAP	Data Collection Quality Assurance Plan
DMS	Data management system
DOE-ID	Department of Energy-Idaho Operations Office
DQO	Data quality objectives
ERP	Environmental Restoration Program
ICPP	Idaho Chemical Processing Plant
IDH&W-DEQ	Idaho Department of Health and Welfare, Division of Environmental Quality
INEL	Idaho National Engineering Laboratory
L&Q	Limitations and qualifications
MDL	Method detection limit
MS/MSD	Matrix spike/matrix spike duplicate
NIST	National Institute of Standards and Technology
NRF	Naval Reactors Facility
PBF	Power Burst Facility
PID	Photoionization detector
QA/QC	Quality assurance/quality control
QAO	Quality assurance officer
QAPP	Quality Assurance Program Plan
RCRA	Resource Conservation and Recovery Act
RSD	Relative standard deviation
RWMC	Radioactive Waste Management Complex
SAP	Sampling and Analysis Plan
SOP	Standard operating procedures
SOW	Statement of work
SRM	Standard reference material
TAN	Test Area North
TCLP	Toxicity characteristic leaching procedure
TMP	Tank Management Program
TPH	Total petroleum hydrocarbons
TRA	Test Reactor Facility
UST	Underground storage tanks
V/V	Verification and validation
VOA	Volatile organic analysis
WHO	EG&G Idaho Waste Handling Operations

SAMPLING AND ANALYSIS PLAN FOR SITE ASSESSMENT DURING THE
CLOSURE OR REPLACEMENT OF NONRADIOACTIVE UNDERGROUND STORAGE TANKS

1. INTRODUCTION

The Tank Management Program (TMP) is responsible for the closure or replacement of nonradioactive underground storage tanks (USTs) throughout the Idaho National Engineering Laboratory (INEL). Regulations contained in 40 CFR 280 (1989a) require the closure and removal of nonessential USTs, and the upgrade or replacement of USTs that are to remain in service. A site assessment of contamination from tank contents must be made during tank closure or replacement activities. This Sampling and Analysis Plan (SAP) directs site assessment and remedial activities associated with the closure or replacement of nonradioactive USTs at the INEL.

Sampling activities involve the field and laboratory assessment of tank excavation backfill materials for contamination from the UST system. This SAP was prepared for the Environmental Restoration Program (ERP), part of the Resource Conservation and Recovery Act (RCRA) Corrective Action Program at the INEL.

This SAP also functions as a Quality Assurance Project Plan (QAPP). The QAPP serves as a controlling mechanism during sampling and analysis to ensure that all data collected are valid, reliable, and defensible. Organization, objectives and quality assurance/quality control (QA/QC) activities are outlined to achieve the desired data quality goals. The QA/QC requirements for this project are detailed in the *Data Collection Quality Assurance Plan (DCQAP) for the Buried Waste Program* (EG&G, 1988). The DCQAP is a program plan and does not include the site specific requirements for the scope of work covered by this SAP.

1.1 Site Background

The INEL is a 2,315-km² (894-mi²), government-owned, contractor-operated facility managed by the U.S. Department of Energy-Idaho Operations Office

(DOE-ID). Located on the Snake River Plain in Southeastern Idaho, the INEL is divided into nine distinct functional areas for reasons of programmatic necessity and functional efficiency. The INEL facility area configuration is illustrated in Figure 1-1 with the nine distinct areas represented by Argonne National Laboratory-West (ANL-W), Auxiliary Reactor Area (ARA), Central Facilities Area (CFA), Idaho Chemical Processing Plant (ICPP), Naval Reactor Facility (NRF), Power Burst Facility (PBF), Radioactive Waste Management Complex (RWMC), Test Area North (TAN), and the Test Reactor Area (TRA).

Closure or replacement of USTs will be performed site wide. Area and site specific geology, soil type, and depth to the aquifer will be included in the closure summary report when appropriate. Inclusion of site specific descriptions will be necessary when soil contamination is evidenced, and in the final, area-wide report.

1.1.1 Geology

The Snake River Plain is a physiographic depression that extends from the Idaho-Oregon border to the Yellowstone Plateau. Much of the surface of the Snake River Plain is covered by waterborne and windborne soils derived primarily from silicic volcanic and sedimentary rocks from surrounding mountains. Underlying the plain are layers of interbedded volcanic and sedimentary rocks, principally basaltic lava with interflow beds of sedimentary materials (EG&G, 1985). The land surface of the INEL is relatively flat and is a semiarid, sagebrush desert. A broad topographic ridge extends from the southwest to the northeast. This ridge effectively separates the Snake River drainage from the mountains to the north and west.

1.1.2 Hydrology

Surface water enters the INEL from localized snowmelt, rain, and from streams draining intermountain valleys to the north and west. Streams entering the INEL include the Big Lost River, Little Lost River, and Birch Creek. Surface stream water is diverted upstream for irrigation purposes and

does not reach the INEL in dry years. During wet portions of the year, usually winter and spring, the Big Lost River may flow through the INEL. Except for evaporation losses, all water from the Big Lost River on the INEL recharges to the perched ground water beneath the river and into the Snake River Plain Aquifer. Birch Creek and Little Lost River have a minimal effect on INEL hydrology.

The Snake River Plain Aquifer is the main body of ground water that underlies the Snake River Plain. Approximately 320 km (200 mi) long and 32 to 97 km (20 to 60 mi) wide, the aquifer comprises an area of about 25,000 km² (9,650 mi²). The depth to the aquifer varies from 61 m (200 ft) in the northeast corner of the INEL to 270 m (900 ft) in the southeast corner. The aquifer contains approximately 2.5×10^{12} m³ (2×10^9 acre-ft) of water. The aquifer has a combined discharge of about 8×10^9 m³ (6.5×10^6 acre-ft) annually through springs in the Hagerman area, upstream from American Falls Reservoir, and through irrigation well withdrawals. The discharges from the springs make a significant contribution to the flow of the Snake River downstream from Twin Falls, Idaho.

Ground water in the aquifer generally flows towards the southwest. Tracer studies performed at the INEL indicate natural flow rates of from 1.5 to 6.1 m (5 to 20 ft) per day with an average of 3 m (10 ft) per day (EG&G, 1985).

1.1.3 Climatology

The INEL is located on the Snake River Plain in Southeastern Idaho near the foothills of the Lost River, Lemhi, and Bitterroot mountain ranges. The average annual precipitation is approximately 21 cm (8 in.), and the mean annual temperature is approximately 5.5°C (42°F). Winters are characteristically cold, with snow cover persisting from December through March. Summers are hot, and temperatures may exceed 38°C (100°F).

1.1.4 Contamination Sources

Contaminated soils may be encountered from tank content spills or leaks. Spills may have occurred during the tank filling process, and leaks may have occurred from any part of the tank system that contained product. All excavation material associated with the tank system will be assessed for contamination from tank contents.

Tank contents are characterized from current inventory records (active tanks) or by laboratory sample analysis if the tank was not in use before closure (out-of-service tanks). Content characterization is used to determine how the tank contents must be handled for disposal and to determine analytes for site contamination assessment. Tank contents that are contaminated with hazardous constituents (CFR, 1989b), other than petroleum constituents, will be classified as hazardous wastes and shipped to a permitted treatment, storage, and disposal site under the direction of the EG&G Idaho Waste Handling Operations (WHO) Unit. Tank contents that were characterized as petroleum products will be shipped to be recycled by burning for energy recovery.

All materials that exhibit contaminant concentrations exceeding the regulatory action limit (Section 2.2.2) will be removed from the excavation, unless the extent of contamination prohibits removal. If removal of all contaminated material is not practical, then the information gathered during the sampling activities will be used as a preliminary site assessment. This information will be submitted to the implementing agencies, which are EPA Region X and the Idaho Department of Health and Welfare, Division of Environmental Quality (IDH&W-DEQ).

1.2 Sampling Objectives

The UST regulations require sample collection and laboratory analysis of tank excavation materials to verify the contamination status if no previous leak detection system is in place before tank removal (CFR, 1989b). Excavation materials will be analyzed during all tank closures or replacements

at the INEL. Field measurements (Section 5.1.1) and laboratory data (Table 6.2) will be used to assess the site at the time of closure or replacement. The objective of this sampling and analysis activity is to determine whether a product release has occurred at the tank site and record the level of contamination.

1.2.1 Data Collection

Excavation materials will be screened for tank content contamination using field operable instruments. A Photovac Microtip PID will be used to screen for volatile organic compounds (VOCs) to help bias sampling locations. Samples of excavation material will be collected and sent to an offsite, contracted laboratory for analysis of tank constituents using EPA approved methods. Field data collection will be EPA analytical support Level II, and laboratory analytical data will be analytical support Level III with equivalent Level IV QA\QC documentation (EPA, 1987a).

1.2.2 Data Usage

Field and laboratory analyses will be used to recommend selective handling procedures for contaminated materials and to create a permanent record of the site contamination status. A summary assessment for each tank closure or replacement will be prepared for inclusion in the individual tank file. If the tank is on the Consent Order and Compliance Agreement (COCA) list, the summary assessment will be used as evidence in the delisting process to remove the tank from the COCA inventory.

2. PROJECT DESCRIPTION

There are 68 active and 85 out-of-service, nonradioactive USTs under the jurisdiction of the TMP. All out-of-service tanks will be closed and removed by the end of 1991, and all active tanks will be upgraded, replaced, or removed by the end of 1993. Tables 2-1 and 2-2 contain information on tank identification and proposed date of sampling activity.

To date, 22 out-of-service USTs cannot be located by using surface features. Many of these tanks may have already been removed, and the records were not available to the TMP. Closure activities for some of these tanks may only involve the verification that they no longer exist. Closure or replacement activities for all other nonradioactive USTs will involve a site assessment of excavation materials for contamination from tank contents.

2.1 Analysis of Existing Data

Current inventory records, historical tank use records, and sampling and laboratory analytical results are used to characterize and verify the tank contents (Tables 2-1 and 2-2). The tank contents from 54 out-of-service tanks were sampled in May and June of 1989 as directed by the *INEL Tank Closure Program Sampling, Analysis, and Disposal Plan for Tank Contents* (EG&G, 1989a). The samples were analyzed and the data were validated by the EG&G Idaho Environmental Chemistry Unit. The analytical results are contained in the individual tank files in the custody of the TMP. The WHO Unit used the data to classify the tank contents as petroleum products, solid wastes, or hazardous wastes. Some samples are still pending decision by the WHO Unit.

This sampling and analysis plan is applicable to all tanks listed in Tables 2-1 and 2-2. All tanks listed in Table 2-1 will be eligible for closure once the tanks are located and the tank contents are characterized. Tanks listed in Table 2-2 will be replaced or closed depending on the facility need. The TMP will concentrate removal activities on out-of-service tank closures until the summer of 1991.

Table 2-1. Out-of-service tanks that will be closed and removed

<u>Tank Identification</u>	<u>Facility</u>	<u>Tank#</u>	<u>Bldg#</u>	<u>Capacity</u>	<u>Inventoried Contents</u>	<u>Status</u>
AR753	ARA-I	743	629		Gasoline	Empty
AR606	ARA-II	606-NW	606	1000	Fuel Oil	Emptied 1989
AR607	ARA-III	607	607	1000	Fuel Oil	Not Found
AR611	ARA-III	611	611	1000	Fuel Oil	Emptied 1989
B0000	BORAX-V			500	Fuel Oil	Emptied 1989
B0601	BORAX-V	601-W	601	500	Fuel Oil	Emptied 1989
B0602	BORAX-V	602-SW	602	500	Fuel Oil	Emptied 1989
CF605	CFA	605W	605		Fuel Oil	Pending Decision
CF606	CFA	606-E1	606	10,000	Gasoline	Not Found
CF606E	CFA	606-E2	606	10,000	Fuel Oil	Not Found
CF606S	CFA	606-SW	606	500	Fuel Oil	Not Found
CF640E	CFA	640-E	640	500	Fuel Oil	Pending Decision
CF640W	CFA	640-W	640		Fuel Oil	Not Found
CF641	CFA	641	641	500	Fuel Oil	Emptied 1989
CF641U	CFA	641-Un	641		Gasoline	Emptied 1989
CF643	CFA	643 MTR	643		Fuel Oil	Not Found
CF656	CFA	656	656	500	Fuel Oil	Emptied 1989
CF667N	CFA	667-N	667	1000	Fuel Oil	Emptied 1989
CF667S	CFA	667-S	667	6000	Fuel Oil	Emptied 1989
CF674B	CFA	674-B	674	1000	Fuel Oil	Pending Decision
CF674S	CFA	674-S	674		Fuel Oil	Emptied 1989
CF674W	CFA	674-W	674		Acid	Removed 1989
CF680	CFA	680	680	55	Gasoline	Pending Decision
CF681S	CFA	681-S	681	500	Fuel Oil	Pending Decision
CF725	CFA	725	683	1000	Fuel Oil	Pending Decision
CF727	CFA	727	687	1000	Fuel Oil	Pending Decision
CF728	CFA	728	666	500	Fuel Oil	Not Found
CF740	CFA	740	669	18,000	Fuel Oil	Emptied 1989
CF746	CFA	746	604	285	Fuel Oil	Emptied 1989
CF763	CFA	763(UNK-4)	667	15,000	Used Oil	Pending Decision
CF629A	CFA	NEV1	629-S	500	Fuel Oil	Not Found
CF629B	CFA	NEV2	629-S	300	Fuel Oil	Not Found
EB704	EBR-I	704 AEF			Fuel Oil	Not Found
EB706	EBR-I	706		4500	Fuel Oil	Pending Decision
EB707	EBR-I	707		1000	Fuel Oil	Emptied 1989
EB708	EBR-I	708		600	Gasoline	Empty
EB703	EBR-I/WMO	703	601	2000	Fuel Oil	Emptied 1989
EB704A	EBR-I/WMO	704	601	500	Fuel Oil	Pending Decision
EB704B	EBR-I/WMO	704	601		Fuel Oil	Sand Filled
EB705	EBR-I/WMO	705	601	50	Gasoline	Pending Decision
EB717	EBR-I/WMO	717	601	500	Gasoline	Not Found
NR001	NRF		GuardGate	5000	Fuel Oil	Not Sampled
NR002	NRF		INSIDE	1500	Fuel Oil	Not Sampled

Table 2-1. (continued)

<u>Tank Identification</u>	<u>Facility</u>	<u>Tank#</u>	<u>Bldg#</u>	<u>Capacity</u>	<u>Inventoried Contents</u>	<u>Status</u>
PB608	PBF	608	608	1000	Fuel Oil	Pending Decision
PB612	PBF-SPI	612		400	Gasoline	Not Sampled
PB609	PBF-SPII	609		200	Used Oil	Sand Filled
TA1705	TAN/IET	1705	625		Lube Oil	Pending Decision
TA1711	TAN/IET	1711	625	50,000	Fuel Oil	Removed 1989
TA1712	TAN/IET	1712	625	30,000	Fuel Oil	Removed 1989
TA1713	TAN/IET	1713	625	20,000	Fuel Oil	Removed 1989
TA1714	TAN/IET	1714	625	550	Lube Oil	Pending Decision
TA1715	TAN/IET	1715	627	5000	Gasoline	Pending Decision
TA1701	TAN/LOFT	1701	630-N		Fire Foam	Not Found
TA764	TAN/LOFT	764	631	15,000	Fuel Oil	Pending Decision
TA765	TAN/LOFT	765	630-S	2000	Jet Fuel	Not Found
TA629	TAN/LOFT	F-A	629	500	Fuel Oil	Rockwell, Not Sam.
TA601S	TAN/TSF	601S	601	100	Fuel Oil	Not Found
TA602	TAN/TSF	602	602		Neutral.	Not Found
TA602E	TAN/TSF	602-E	N/A		Fuel Oil	Emptied 1989
TA604	TAN/TSF	604	604		Clarific.	Pending Decision
TA605S	TAN/TSF	605S	605	1000	Fuel Oil	Not Found
TA607	TAN/TSF	607	607	3000	Waste Oil	Not Found
TA775	TAN/TSF	775	609	10,000	Jet Fuel	Empty
TA777A	TAN/TSF	777A	603	3,000	Diesel	Not Found
TA777B	TAN/TSF	777B	603	12,000	Fuel Oil	Pending Decision
TA777C	TAN/TSF	777C	603	12,000	Jet Fuel	Not Found
TA779	TAN/TSF	779	603	500	Fuel Oil	Emptied 1989
TA1702	TAN/TSF	1702	607-W	3000	Fuel Oil	Emptied 1989
TA1709	TAN/TSF	1709	616		Neutral.	Not Sampled
TA1721	TAN/TSF	1721	610	550	Gasoline	Not Found
TA1706	TAN/WRRTF	1706	641	1000	Fuel Oil	Emptied 1989
TA644	TAN/WRRTF	644	644	550	Gasoline	Emptied 1989
TA751	TAN/WRRTF	751	640	12,000	Fuel Oil	Emptied 1989
TA753	TAN/WRRTF	753	663	50,000	Fuel Oil	Pending Decision
TA755	TAN/WRRTF	755	645	5000	Fuel Oil	Pending Decision
TA788	TAN/WRRTF	788	645	2500	Fuel Oil	Emptied 1989
TA789	TAN/WRRTF	789	646	5000	Fuel Oil	Emptied 1989
TR605	TRA	605	605	160	Gasoline	Removed 1989
TR609	TRA	609	609		Boiler Bl.	Pending Decision
TR610	TRA	610	610	265	Gasoline	Removed 1989
TR616	TRA	616	616	1000	Gasoline	Pending Decision
TR623	TRA	623	623	300	Fuel Oil	Emptied 1989
TR643	TRA	643	643	300	Fuel Oil	Removed 1989
TR648	TRA	648	648	1500	Fuel Oil	Empty
TR667E	TRA	667-E	667	5000	Fuel Oil	Pending Decision

Table 2-2. Active tanks that will be upgraded, replaced, or closed and removed

<u>Tank Identification</u>	<u>Facility</u>	<u>Tank#</u>	<u>Bldg#</u>	<u>Capacity</u>	<u>Inventoried Contents</u>	<u>Status</u>
CF002	CFA	2	FireS	1000	Fuel Oil	
CF688	CFA	688	688	500	Fuel Oil	
CF7134	CFA	713-4	664-4	10,000	Gasoline	
CF7135	CFA	713-5	664-5	8000	Gasoline	
CF721	CFA	721	662	5000	Fuel Oil	
CF729	CFA	729	668	1000	Fuel Oil	
CF730	CFA	730	613	500	Fuel Oil	
CF731	CFA	731	608	12,000	Jet Fuel	
CF732	CFA	732	608	12,000	Fuel Oil	
CF734	CFA	734	607	500	Fuel Oil	
CF735	CFA	735	614	500	Fuel Oil	
CF737	CFA	737	688	2000	Fuel Oil	
CF738	CFA	738	656	2500	Fuel Oil	
CF739	CFA	739	656	2500	Fuel Oil	
CF7416	CFA	741-6	645-6	10,000	Fuel Oil	Removed 1989
CF7417	CFA	741-7	645-7	10,000	Fuel Oil	
CF743	CFA	743	664	2000	Waste Oil	Removed 1989
CF744	CFA	744	665	1000	Waste Oil	Removed 1989
CF747	CFA	747	605	1000	Fuel Oil	
CF748	CFA	748	682	500	Fuel Oil	
CF748	CFA	748	606	500	Fuel Oil	
CF757	CFA	757	665	12,000	Fuel Oil	
CF759	CFA	759	671	17,000	Fuel Oil	
IFBUS1	IF-BUS	01SSW103		5000	Gasoline	
IFBUS2	IF-BUS	01SSW111		10,000	Fuel Oil	
IFROB	IF-IRC	01SSW104	ROB	6000	Gasoline	
IFIRC1	IF-IRC	1	IRC	300	Fuel Oil	
IFIRC2	IF-IRC	2	IRC	2000	Fuel Oil	
IFWCB	IF-WCB	139497	WCB	300	Fuel Oil	
NR606A	NRF	01SSW503	606	6000	Gasoline	
NR606B	NRF	01SSW511	606	6000	Fuel Oil	
PB601A	PBF	601	601	1000	Fuel Oil	
PB601B	PBF	601	601	2000	Fuel Oil	
PB632	PBF	632	632	2000	Fuel Oil	
PB721	PBF	721	621	500	Gasoline	
PB722	PBF	722	620	10,000	Fuel Oil	
PB737	PBF	737	619	2000	Fuel Oil	
PB749	PBF	749	625	5000	Fuel Oil	
PB740	PBF	740	601-S	1000	Fuel Oil	
PB741	PBF	741	626	1000	Fuel Oil	Removed 1989
PB742	PBF	742	601-E	1000	Fuel Oil	
PB743	PBF	743	632-W	2000	Fuel Oil	
PB752	PBF-SPII	752	612	2000	Fuel Oil	

Table 2-2. (continued)

<u>Tank Identification</u>	<u>Facility</u>	<u>Tank#</u>	<u>Bldg#</u>	<u>Capacity</u>	<u>Inventoried Contents</u>	<u>Status</u>
PB719	PBF-SPII	719		3000	Fuel Oil	
PB716	PBF-SPIV	716	613-N	4000	Fuel Oil	
TA766	TAN/LOFT	766	630-S	50,000	Fuel Oil	
TA767A	TAN/LOFT	767-A	630-S	35,000	Fuel Oil	
TA767B	TAN/LOFT	767-B	630-S	35,000	Fuel Oil	
TA783	TAN/TSF	783	664	12,000	Gasoline	
TA792	TAN/TSF	792	611	10,000	Fuel Oil	
TA794	TAN/TSF	794	607	1000	Fuel Oil	
TA797	TAN/TSF	797	603	1000	Fuel Oil	
TA738	TAN/WRRTF	738	641	10,000	Fuel Oil	
TA759	TAN/WRRTF	759	652	1000	Gasoline	
TA787	TAN/WRRTF	787	645	10,000	Fuel Oil	
TR707	TRA	707	606	2900	Gasoline	
TR759	TRA	759	620	5000	Fuel Oil	Removed 1989
TR776	TRA	776	670	1500	Fuel Oil	
CP6003	WINCO-CPP	CFG-6003		3000	Fuel Oil	Removed 1989
CP102	WINCO-CPP	HCB-102		1000	Kerosene	
CP1401	WINCO-CPP	NCE-140-1		5000	Fuel Oil	
CP1402	WINCO-CPP	NCE-140-2		5000	Fuel Oil	
CP152	WINCO-CPP	SAA 152		1000	Fuel Oil	
CP153	WINCO-CPP	SAA 153		2000	Gasoline	
CP653	WINCO-CPP	UTI-653		1000	Fuel Oil	
CP654	WINCO-CPP	UTI-654		55	Used Oil	
CP655	WINCO-CPP	UTI-655		1000	Fuel Oil	
CP106	WINCO-CPP	YDA-106		550	Hexone	

2.2 Data Quality Objectives

The Data Quality Objectives (DQOs) of this SAP are to perform site assessments at the time of tank removal for closure or replacement as directed by the UST regulations (CFR, 1989a). The activities in this SAP will follow the procedures outlined in UST guidance documents on tank closure (GII, 1989, California State Water Resources Control Board, 1988).

2.2.1 Decisions to be Made

The Environmental Technology Unit as directed by the Tank Management Program, will assess the tank excavation materials for evidence of contamination. Laboratory analysis of excavation material samples will be used to determine the presence and extent of contamination remaining in the tank excavation. Decisions to be made depend on tank content classification as petroleum products, hazardous wastes (because of hazardous constituents other than petroleum constituents), or solid wastes.

Tanks that contain petroleum products have cleanup standards that are less stringent than tanks containing materials that will be disposed of as hazardous wastes. Action levels for contaminant concentrations (Section 2.2.2) are in accordance with 40 CFR 280 subparts F and G (CFR, 1989a) and 40 CFR 265.197 (CFR, 1989c). Action levels for cleanup will be in concurrence with the implementing agencies (EPA Region X and the IDH&W-DEQ).

Excavation materials that exhibit analyte concentrations below the regulatory action levels will be considered uncontaminated as per agreement with EPA Region X and the IDH&W-DEQ. These agencies have given the TMP the authority to declare a site uncontaminated if analyte concentrations are below the action levels. If analyte concentrations exceed action levels, then cleanup standards must be negotiated with EPA Region X and the IDH&W-DEQ.

To be on the conservative side, the TMP will declare materials uncontaminated if the benzene, toluene, ethylbenzene, and xylene (BTEX) and total petroleum hydrocarbon (TPH) concentrations are 20% below the regulatory

action levels (see Section 2.2.2). Contaminant concentrations that exceed the TMP imposed action level will be subject to negotiation with EPA Region X and the IDH&W-DEQ.

2.2.2 Information Required to Make Decisions

The cleanup and closure status for each UST will be based upon the presence and extent of contaminants in the excavation backfill and soil associated with each tank. To make site closure decisions, contaminant concentrations in backfill and soil are compared to action levels as per agreement with EPA Region X and the IDH&W-DEQ. If contaminant concentrations exceed action levels, then closure may be achieved by soil removal. If removal of soil material to reduce contamination concentrations below action levels is not practicable, then residual contamination levels will be reported, and cleanup standards will be negotiated with EPA Region X and the IDH&W-DEQ.

Regulatory action levels for tanks containing petroleum products are set at 100 ppm TPH for gasoline and 1000 ppm TPH for fuel oil. Tank Management Program action levels are set at 80 ppm for gasoline and 800 ppm for fuel oil. Action levels for organics other than petroleum constituents are set at three times the method detection limit (MDL), and action levels for metals are determined from background samples. Background sampling and analysis for tank constituents will only be performed for tanks that contained hazardous, inorganic materials. Background sample collection is discussed in greater detail in Section 2.2.4.1. Action levels are discussed in detail in Section 4.3.

2.2.3 Potential Consequences of Inadequate Environmental Data

Environmental data that are not truly representative of the tank excavation materials or background soils could lead to incorrect site closure decisions. Data that erroneously indicate the presence and elevated concentrations of backfill and soil contamination would unnecessarily trigger the removal and disposal of excavation backfill and soil material. They may

result in an over-expenditure of available human and financial resources. Conversely, data that incorrectly indicate a lack of contamination would result in the failure to address an existing contamination problem.

False negatives result from data that indicate a non-contamination status when a contamination problem does exist. Biased sample selection through field screening of visual and volatile contamination and association to tank contact points in the excavation will reduce the chance of a false negative.

2.2.4 Specific Environmental Data Required

Representative samples of excavation backfill and associated soil materials must be analyzed to determine contaminant concentrations. Concentrations of contaminants are compared to action levels to determine the site contamination status.

2.2.4.1 Contaminant Levels in Excavation Materials. Excavated materials associated with tanks that contained petroleum products will be analyzed for the aromatic volatile organics benzene, toluene, ethylbenzene, and xylene (BTEX) and for TPH. Backfill and soil associated with tanks that were characterized to contain hazardous substances other than petroleum constituents will be analyzed for those specific compounds, following the procedures used to verify the hazard status (EG&G, 1989a). Where appropriate, excavation materials associated with hazardous waste tanks will be analyzed for petroleum products. Analytical methods are described in detail in Section 4.2.

2.2.4.2 Analyte Levels in Background Soils. Background samples are collected and analyzed to provide a baseline for determining contamination levels. Background levels of petroleum constituents in INEL soils were below detection limits on all samples submitted and analyzed by a contract laboratory in 1989. Background sample collection is therefore considered unnecessary for analysis of organic constituents.

Where applicable, background samples will be collected and analyzed for naturally occurring concentrations of inorganic compounds (Section 4.1).

Background sample analysis of inorganics only will be necessary during site assessments of tanks that contained hazardous concentrations of inorganic constituents. In these cases, representative, undisturbed surface soils from the general site area will be sampled and analyzed to determine baseline concentrations of tank constituents.

2.2.5 Domain of Decision

This SAP addresses site assessments for the closure or replacement of all INEL underground storage tanks regulated under 40 CFR 280 (CFR, 1989a). Actions resulting from evaluation of site specific data will impact each site. Should data from sampling efforts indicate contamination above regulatory action levels, land adjacent to these areas may be impacted during corrective actions or removal of the contaminated soil.

2.2.6 Information to be Derived from Environmental Data

Laboratory data resulting from the sampling and analysis effort will be evaluated to determine if contaminant concentrations exceed action levels. This information will be used to assess the site at closure or replacement, and to determine the need for extensive soil removal, or negotiations with EPA Region X and the IDH&W-DEQ. Where applicable, these data will be used to select site closure options for tanks placed on the COCA list.

2.2.7 Need for New Environmental Data

A site assessment for contamination from tank constituents must be performed during tank closure, as per 40 CFR 280 Subpart G (CFR, 1989a). The sampling and analyses activities outlined in this plan will provide the necessary information for site closure.

A site assessment for contamination from tank constituents also will be performed during each tank replacement. This is done to analyze for contaminants released from the old tank system. If practical, all detectably contaminated materials will be removed from the excavation before new tank placement in the excavation.

3. PROJECT ORGANIZATION AND RESPONSIBILITY

3.1 Organization

Several organizations will be directly involved in the performance and review of this project. The project documentation receives internal review, outlined in the ERP "Program Directive for the Preparation of Sampling and Analysis Plans" (EG&G, 1990). An organization chart for UST closure sampling and analysis activities at the INEL is shown in Figure 3-1.

3.2 Responsibility

The duties of the key personnel designated to prepare all plans and to conduct work required for this project are as follows:

- The tank program manager is responsible for program oversight.
- The tank project manager is responsible for directing the project team, reviewing and editing project documentation, and for communicating with the tank program manager and the field team.
- The sampling and analysis coordinator is responsible for the preparation of this SAP, the coordination of field work, laboratory work, and summary document preparation.
- The field team is responsible for field site assessments, sample collection and shipment, corrective action response, and summary document preparation.

Figure 3-1 outlines the key personnel who will support the closure or replacement activities in 1990.

Figure 3-1. Organization chart for site assessments during UST removal or replacement.

4. FIELD SAMPLING INFORMATION

Sample collection and laboratory analysis will be necessary to perform site assessments during all UST removal activities for tank closures or tank replacements. Table 4-1 contains the list of INEL out-of-service USTs to be closed, and Table 4-2 contains the list of INEL active tanks to be closed or replaced. Included in these tables is information necessary to determine sample identification number (Section 6.1.3), sample number, and laboratory analysis type. Analysis type is left blank for those tanks that have yet to be sampled or are pending decision by the WHO Unit. Proposed year of sampling activity for the out-of-service tanks is included in Table 4-1.

Removal and closure or replacement of a UST involves the use of heavy machinery to excavate backfill materials above a tank system and to remove the tank system from the excavation. The sampling strategy was prepared to allow the collection of environmental samples in conjunction with tank removal operation.

4.1 Sample Location and Frequency

Excavated materials will be screened in the field for evidence of contamination from tank constituents. Field screening will involve the use of visual observation of excavated materials for discoloration and the use of a portable photoionization detector to evaluate the presence of VOCs. Field screening methods will help determine the location and frequency of samples collected for laboratory analysis.

4.1.1 Tank Closure Sampling Scheme for Tanks Containing Petroleum Products

The sampling field team leader will have to make decisions in the field based on environmental conditions associated with a petroleum UST. The sampling scheme to be used and the decisions to be made in the field during the closure of a petroleum tank are as follows:

Table 4-1. List of out-of-service tanks to be closed and removed

<u>Tank Identification</u>	<u>Sample Id # (Range)</u>	<u>Tank Capacity</u>	<u>Sample # Range</u>	<u>Analysis Type</u>	<u>Tank Contents</u>	<u>Proposed Date</u>
ARA753	UA000-UA019		5-20	BTEX, TPH	Gasoline	1990
ARA606	UA020-UA039	1000	5-20	BTEX, TPH	Fuel Oil	1990
ARA607	UA040-UA059	1000	5-20		Fuel Oil	1991
ARA611	UA060-UA079	1000	5-20	BTEX, TPH	Fuel Oil	1990
BOR000	UB000-UB019	500	5-20	BTEX, TPH	Fuel Oil	1990
BOR601	UB020-UB039	500	5-20	BTEX, TPH	Fuel Oil	1990
BOR602	UB040-UB059	500	5-20	BTEX, TPH	Fuel Oil	1990
CFA605	UC000-UC019		5-20		Fuel Oil	1990-91
CFA606	UC020-UC039	10000	5-20		Gasoline	1991
CFA606E	UC040-UC059	10000	5-20		Fuel Oil	1991
CFA606S	UC060-UC079	500	5-20		Fuel Oil	1991
CFA640E	UC080-UC099	500	5-20		Fuel Oil	1990-91
CFA640W	UC100-UC119		5-20		Fuel Oil	1991
CFA641	UC120-UC139	500	5-20	BTEX, TPH	Fuel Oil	1990
CFA641U	UC140-UC159		5-20	BTEX, TPH	Gasoline	1990
CFA643	UC160-UC179		5-20		Fuel Oil	1991
CFA656	UC180-UC199	500	5-20	BTEX, TPH	Fuel Oil	1990
CFA667N	UC200-UC219	1000	5-20	BTEX, TPH	Fuel Oil	1990
CFA667S	UC220-UC239	6000	5-20	BTEX, TPH	Fuel Oil	1990
CFA674B	UC240-UC259	1000	5-20		Fuel Oil	1990-91
CFA674S	UC260-UC279		5-20	BTEX, TPH	Fuel Oil	1990
CFA674W	UC280-UC299		5-20	BTEX, TPH	Acid	1989
CFA680	UC300-UC319	55	5-20		Gasoline	1990-91
CFA681S	UC320-UC339	500	5-20		Fuel Oil	1990-91
CFA725	UC340-UC359	1000	5-20		Fuel Oil	1990-91
CFA727	UC360-UC379	1000	5-20		Fuel Oil	1990-91
CFA728	UC380-UC399	500	5-20		Fuel Oil	1991
CFA740	UC400-UC419	18000	5-20	BTEX, TPH	Fuel Oil	1990
CFA746	UC420-UC439	285	5-20	BTEX, TPH	Fuel Oil	1990
CFA763	UC440-UC459	15000	5-20		Used Oil	1990-91
CFA629A	UC460-UC479	500	5-20		Fuel Oil	1991
CFA629B	UC480-UC499	300	5-20		Fuel Oil	1991
EBR704	UE000-UE019		5-20		Fuel Oil	1991
EBR706	UE020-UE039	4500	5-20		Fuel Oil	1990-91
EBR707	UE040-UE059	1000	5-20	BTEX, TPH	Fuel Oil	1989
EBR708	UE060-UE079	600	5-20	BTEX, TPH	Gasoline	1990
EBR703	UE080-UE099	2000	5-20	BTEX, TPH	Fuel Oil	1990
EBR704A	UE100-UE119	500	5-20		Fuel Oil	1990-91
EBR704B	UE120-UE139		5-20	BTEX, TPH	Fuel Oil	1990
EBR705	UE140-UE159	50	5-20		Gasoline	1990-91
EBR717	UE160-UE179	500	5-20		Gasoline	1991
NRF001	UN000-UN019	5000	5-20		Fuel Oil	1991
NRF002	UN020-UN039	1500	5-20		Fuel Oil	1991
PBF608	UP000-UP019	1000	5-20		Fuel Oil	1990-91

Table 4-1. (continued)

<u>Tank Identification</u>	<u>Sample Id # (Range)</u>	<u>Tank Capacity</u>	<u>Sample # Range</u>	<u>Analysis Type</u>	<u>Tank Contents</u>	<u>Proposed Date</u>
PBF612	UP020-UP039	400	5-20		Gasoline	1991
PBF609	UP040-UP059	200	5-20	BTEX, TPH	Used Oil	1990
TAN1705	UT000-UT019		5-20		Lube Oil	1990-91
TAN1711	UT020-UT039	50000	7-20	BTEX, TPH	Fuel Oil	1989
TAN1712	UT040-UT059	30000	7-20	BTEX, TPH	Fuel Oil	1989
TAN1713	UT060-UA079	20000	5-20	BTEX, TPH	Fuel Oil	1989
TAN1714	UT080-UT099	550	5-20		Lube Oil	1990-91
TAN1715	UT100-UT119	5000	5-20		Gasoline	1990-91
TAN1701	UT120-UT139		5-20		Fire Fm.	1991
TAN764	UT140-UT159	15000	5-20		Fuel Oil	1990-91
TAN765	UT160-UT179	2000	5-20		Jet Fuel	1991
TAN629	UT180-UT199	500	5-20		Fuel Oil	1991
TAN601S	UT200-UT219	100	5-20		Fuel Oil	1991
TAN602	UT240-UT259		5-20		Neutral.	1991
TAN602E	UT260-UT279		5-20	BTEX, TPH	Fuel Oil	1990
TAN604	UT280-UT299		5-20		Clarifi.	1990-91
TAN605S	UT300-UT319	1000	5-20		Fuel Oil	1991
TAN607	UT320-UT339	3000	5-20		Waste Oil	1991
TAN775	UT340-UT359	10000	5-20	BTEX, TPH	Jet Fuel	1990
TAN777A	UT360-UT379	3000	5-20		Diesel	1991
TAN777B	UT380-UT399	12000	5-20		Fuel Oil	1990-91
TAN777C	UT400-UT419	12000	5-20		Jet Fuel	1991
TAN779	UT420-UT439	500	5-20	BTEX, TPH	Fuel Oil	1990
TAN1702	UT440-UT459	3000	5-20	BTEX, TPH	Fuel Oil	1990
TAN1709	UT460-UT479		5-20		Neutral.	1991
TAN1721	UT480-UT499	550	5-20		Gasoline	1991
TAN664	UT500-UT519	550	5-20	BTEX, TPH	Gasoline	1990
TAN751	UT520-UT539	12000	5-20	BTEX, TPH	Fuel Oil	1990
TAN753	UT540-UT559	50000	7-20		Fuel Oil	1990-91
TAN755	UT560-UT579	5000	5-20		Fuel Oil	1990-91
TAN788	UT580-UT599	2500	5-20	BTEX, TPH	Fuel Oil	1990
TAN789	UT600-UT619	5000	5-20	BTEX, TPH	Fuel Oil	1990
TAN1706	UT620-UT639	1000	5-20	BTEX, TPH	Fuel Oil	1990
TRA605	UR000-UR019	160	5-20	BTEX, TPH	Gasoline	1989
TRA609	UR020-UR039		5-20		BoilerB	1990-91
TRA610	UR040-UR059	265	5-20	BTEX, TPH	Gasoline	1990
TRA616	UR060-UR079	1000	5-20		Gasoline	1990-91
TRA623	UR080-UR099	300	5-20	BTEX, TPH	Fuel Oil	1990
TRA643	UR100-UR119	300	5-20	BTEX, TPH	Fuel Oil	1989
TR648	UR120-UR139	1500	5-20	BTEX, TPH	Fuel Oil	1990
TRA667E	UR140-UR159	5000	5-20		Fuel Oil	1990-91

Table 4-2. List of active tanks to be removed and closed or replaced

<u>Tank Identification</u>	<u>Sample Id # (Range)</u>	<u>Tank Capacity</u>	<u>Sample # Range</u>	<u>Analysis Type</u>	<u>Tank Contents</u>
CFA002	UC500-UC519	1000	5-20	BTEX, TPH	Fuel Oil
CFA688	UC520-UC539	500	5-20	BTEX, TPH	Fuel Oil
CFA7134	UC540-UC559	10000	5-20	BTEX, TPH	Gasoline
CFA7135	UC560-UC579	8000	5-20	BTEX, TPH	Gasoline
CFA721	UC580-UC599	5000	5-20	BTEX, TPH	Fuel Oil
CFA729	UC600-UC619	1000	5-20	BTEX, TPH	Fuel Oil
CFA730	UC620-UC639	500	5-20	BTEX, TPH	Fuel Oil
CFA731	UC640-UC659	12000	5-20	BTEX, TPH	Jet Fuel
CFA732	UC660-UC679	12000	5-20	BTEX, TPH	Fuel Oil
CFA734	UC680-UC699	500	5-20	BTEX, TPH	Fuel Oil
CFA735	UC700-UC719	500	5-20	BTEX, TPH	Fuel Oil
CFA737	UC720-UC739	2000	5-20	BTEX, TPH	Fuel Oil
CFA738	UC740-UC759	2500	5-20	BTEX, TPH	Fuel Oil
CFA739	UC760-UC779	2500	5-20	BTEX, TPH	Fuel Oil
CFA7416	UC780-UC799	10000	5-20	BTEX, TPH	Fuel Oil
CFA7417	UC800-UC819	10000	5-20	BTEX, TPH	Fuel Oil
CFA743	UC820-UC839	2000	5-20	BTEX, TPH	Waste Oil
CFA744	UC840-UC859	1000	5-20	BTEX, TPH	Waste Oil
CFA747	UC860-UC879	1000	5-20	BTEX, TPH	Fuel Oil
CFA748A	UC880-UC899	500	5-20	BTEX, TPH	Fuel Oil
CFA748B	UC900-UC919	500	5-20	BTEX, TPH	Fuel Oil
CFA757	UC920-UC939	12000	5-20	BTEX, TPH	Fuel Oil
CFA759	UC940-UC959	17000	5-20	BTEX, TPH	Fuel Oil
IFBUS1	UI000-UI019	5000	5-20	BTEX, TPH	Gasoline
IFBUS2	UI020-UI039	10000	5-20	BTEX, TPH	Fuel Oil
IFROB	UI040-UI059	6000	5-20	BTEX, TPH	Gasoline
IFIRC1	UI060-UI079	300	5-20	BTEX, TPH	Fuel Oil
IFIRC2	UI080-UI099	2000	5-20	BTEX, TPH	Fuel Oil
IFWCB	UI100-UI119	300	5-20	BTEX, TPH	Fuel Oil
NRF606A	UN040-UN059	6000	5-20	BTEX, TPH	Gasoline
NRF606B	UN060-UN079	6000	5-20	BTEX, TPH	Fuel Oil
PBF601A	UP060-UP079	1000	5-20	BTEX, TPH	Fuel Oil
PBF601B	UP080-UP099	2000	5-20	BTEX, TPH	Fuel Oil
PBF632	UP100-UP119	2000	5-20	BTEX, TPH	Fuel Oil
PBF721	UP120-UP139	500	5-20	BTEX, TPH	Gasoline
PBF722	UP140-UP159	10000	5-20	BTEX, TPH	Fuel Oil
PBF737	UP160-UP179	2000	5-20	BTEX, TPH	Fuel Oil
PBF749	UP180-UP199	5000	5-20	BTEX, TPH	Fuel Oil
PBF740	UP200-UP219	1000	5-20	BTEX, TPH	Fuel Oil
PBF741	UP220-UP239	1000	5-20	BTEX, TPH	Fuel Oil
PBF742	UP240-UP259	1000	5-20	BTEX, TPH	Fuel Oil
PBF743	UP260-UP279	2000	5-20	BTEX, TPH	Fuel Oil
PBF752	UP280-UP299	2000	5-20	BTEX, TPH	Fuel Oil
PBF719	UP300-UP319	3000	5-20	BTEX, TPH	Fuel Oil
PBF716	UP320-UP339	4000	5-20	BTEX, TPH	Fuel Oil

Table 4-2. (continued)

<u>Tank Identification</u>	<u>Sample Id # (Range)</u>	<u>Tank Capacity</u>	<u>Sample # Range</u>	<u>Analysis Type</u>	<u>Tank Contents</u>
TAN766	UT520-UT539	50000	7-20	BTEX, TPH	Fuel Oil
TAN767A	UT540-UT559	35000	7-20	BTEX, TPH	Fuel Oil
TAN767B	UT560-UT579	35000	7-20	BTEX, TPH	Fuel Oil
TAN783	UT580-UT599	12000	5-20	BTEX, TPH	Gasoline
TAN792	UT600-UT619	10000	5-20	BTEX, TPH	Fuel Oil
TAN794	UT620-UT639	1000	5-20	BTEX, TPH	Fuel Oil
TAN797	UT640-UT659	1000	5-20	BTEX, TPH	Fuel Oil
TAN738	UT660-UT679	10000	5-20	BTEX, TPH	Fuel Oil
TAN759	UT680-UT699	1000	5-20	BTEX, TPH	Gasoline
TAN787	UT700-UT719	10000	5-20	BTEX, TPH	Fuel Oil
TRA707	UR160-UR179	2900	5-20	BTEX, TPH	Gasoline
TRA759	UR180-UR199	5000	5-20	BTEX, TPH	Fuel Oil
TRA776	UR200-UR219	1500	5-20	BTEX, TPH	Fuel Oil
CPP6003	UW000-UW019	3000	5-20	BTEX, TPH	Fuel Oil
CPP102	UW020-UW039	1000	5-20	BTEX, TPH	Kerosene
CPP1401	UW040-UW059	5000	5-20	BTEX, TPH	Fuel Oil
CPP1402	UW060-UW079	5000	5-20	BTEX, TPH	Fuel Oil
CPP152	UW080-UW099	1000	5-20	BTEX, TPH	Fuel Oil
CPP153	UW100-UW119	2000	5-20	BTEX, TPH	Gasoline
CPP653	UW120-UW139	1000	5-20	BTEX, TPH	Fuel Oil
CPP654	UW140-UW159	55	5-20	BTEX, TPH	Used Oil
CPP655	UW160-UW179	1000	5-20	BTEX, TPH	Fuel Oil
CPP106	UW180-UW199	550	5-20	BTEX, TPH	Hexone

1. Observe the removal of excavated material by the equipment operator.
2. If the excavated material is visibly contaminated from tank product, in the form of dark stains or an oily sheen, then go to 9.
3. Collect one sample for field VOC analysis for every 5 m³ of material removed. Collect samples for field VOC analysis in the materials adjacent to the fill port and directly above the tank because of the high probability of contamination in these areas. Refer to Section 5.1.1 for field screening and data recording procedures.
4. If Microtip PID readings exceed the field action level of 25 ppm VOC for gasoline tanks or 50 ppm for fuel oil tanks, then go to 10.
5. Continue to observe and sample the excavated materials until the tank is sufficiently uncovered to allow tank removal. If excavated material is visibly contaminated from tank product, then go to 9. If the Microtip PID readings exceed field action levels mentioned above, then go to 10.
6. Once removed, observe the tank and piping for corrosion, cracks, or holes indicating a loss in tank integrity. If changes in tank integrity are apparent, then check for contamination in the areas of the tank excavation associated with these areas of the tank. Arrange to have the tank bottom and sides photographed to document tank integrity.
7. Visually inspect the excavation for signs of contamination from tank product. If contamination is visible then go to 9.

8. Collect samples of materials remaining in the tank excavation, even if there is no detectable evidence of contamination from tank product. Select sample locations that are biased to areas with the tank and in areas associated with changes in tank integrity. Refer potentially highest level of contamination. These locations are along the tank keel line at points along the outer edge of the tank and in areas associated with changes in tank integrity. Refer to Section 5.1.2 for sample collection procedures and Table 4-1 or 4-2 for appropriate sample label.

To avoid entering the excavation, direct the equipment operator to remove materials from the selected sampling locations. The excavation may be entered by the field sampler only at the direction of the job site supervisor after consulting safety personnel.

4.1.2 Excavation Materials that Exhibit Contamination

9. Visibly contaminated material must be selectively handled, and sent to the CFA landfill for landfarming. Direct the equipment operator to place all visibly contaminated material in one location. Collect one representative sample for every 5 m³ of visibly contaminated excavation material for field screening of VOCs. Refer to Section 5.1.1 for field screening and data recording procedures.
10. Excavated materials that have field VOC concentrations exceeding 25 ppm for gasoline tanks and 50 ppm for diesel tanks must be sent to the CFA landfill for landfarming. Direct the equipment operator to place all material with known or suspected elevated VOCs in one location.
11. All visible, and otherwise detectable contaminated material underneath the tank should be removed from the excavation. If the

detectable contamination underneath the tank proves extensive, then go to 13.

12. Select sample locations that are biased to areas with the highest potential contamination from tank product. Sample locations should include areas directly below materials that were detectably contaminated and removed. Sample locations along the tank keel line and at points along the outer edge of the tank also should be selected. Refer to Section 5.1.2 for sample collection procedures and Table 4-1 or 4-2 for appropriate sample label.
13. If the detectable contamination underneath the tank proves extensive and difficulties arise in the removal of these materials, then the permissible residual contamination level in the excavation must be negotiated with the implementing agency. Direct the equipment operator to remove as much contaminated material as practicable.
14. Select sample locations that are biased to areas with the highest potential contamination from tank product. Sample locations should include areas that are darkly stained, have an oily sheen, or have VOC concentrations over the field action levels. Sample locations along the tank keel line, and at points along the outer edge of the tank also should be selected in an effort to characterize the extent of contamination. Refer to Section 5.1.2 for sample collection procedures and Table 4-1 or 4-2 for appropriate sample label.

4.1.3 Backfilling the Petroleum Tank Excavation

The tank excavation may be backfilled immediately after sample collection if there is no visible contamination from tank product in the tank excavation, and the VOC concentrations are below field action levels. Otherwise, the tank excavation must remain open until the contamination status is confirmed by laboratory analysis. Cleanup standards for materials with contamination

levels above the regulatory actions limits must be negotiated with the implementing agencies.

4.1.4 Tank Closure Sampling Scheme for Tanks Containing Hazardous Constituent other than Petroleum

Regulatory action limits for hazardous constituents other than petroleum are much stricter than action limits for petroleum products. Materials associated with these tanks must therefore be handled more selectively, and the sampling will proceed as follows:

1. Observe the removal of excavated material by the equipment operator. All excavated material must be placed on a protective plastic cover to prevent contamination of additional materials.
2. Collect one sample for laboratory analysis of tank constituents for every 5 m³ of material removed. Refer to Section 5.1.2 for sample collection procedures.
3. Continue to observe and sample the excavated materials until the tank is sufficiently uncovered to allow tank removal.
4. Once removed, observe the tank and piping for corrosion, cracks, or holes that would indicate a loss in tank integrity. If changes in tank integrity are apparent, then check for contamination in the areas of the tank excavation associated with these areas of the tank. Arrange to have the tank bottom and sides photographed to document tank integrity.
5. Visually inspect the excavation for signs of contamination from tank product. Bias sample locations to areas of detectable contamination, if applicable.
6. Select sample locations that are biased to areas with the potentially highest level of contamination. These locations are

along the tank keel line, at points along the outer edge of the tank, and in areas associated with changes in tank integrity. Refer to Section 5.1.2 for sample collection procedures and Table 4-1 or 4-2 for appropriate sample label.

To avoid entering the excavation, direct the equipment operator to remove materials from the selected sampling locations. The excavation may be entered by the field sampler only at the direction of the job site supervisor after consulting safety personnel.

4.1.5 Backfilling the Hazardous Constituent Tank Excavation

The excavation from a tank containing hazardous constituents other than petroleum may not be backfilled until after laboratory results are received and validated. If laboratory analysis indicate that there are no contaminated materials remaining in the excavation, then the excavation may be backfilled. If contamination over regulatory action levels exist in the excavation, then corrective actions specific to the site will have to be taken.

4.1.6 Background Sample Collection

Five surface composite samples will be collected per tank removal. These samples will be collected in an undisturbed area in close proximity to the UST. An undisturbed area is characterized by older vegetation and no visible surface disturbance. One inch of surface material will be scraped away, and then the background sample will be collected (Section 5.1.2). Background samples will be analyzed for the inorganic constituents of the associated tank after toxicity characteristic leaching procedure (TCLP) extraction.

4.1.7 Quality Control Sampling

Quality control sampling will vary depending on the tank contents because of the range of action levels used for contamination status. Rinsate and trip blanks would have little significance on petroleum contaminated samples that have action levels of 100 ppm for gasoline and 1000 ppm for diesel. Therefore, quality control samples for petroleum USTs will be limited to one field replicate per tank closure. A second replicate per tank closure may be included if non-homogenous contamination is evidenced in the material remaining in the excavation. Where appropriate, rinsate blanks, trip blanks, and field replicates (one per 10 samples) will be collected for analysis of hazardous constituents other than petroleum.

4.1.8 Permanent Identification of the Tank Site

The location of the UST will be referenced to surrounding buildings to permanently identify the tank site. A map indicating the distance from the tank site to surrounding buildings will be prepared and included in the permanent tank file.

4.2 Sample Analysis

Sample analysis type will depend on the classification of the tank contents. Excavation materials from tanks that contained petroleum products will be analyzed for petroleum constituents. Excavation materials from tanks that contained hazardous constituents other than petroleum will be analyzed for those hazardous constituents.

4.2.1 Petroleum Tanks

Excavation materials associated with tanks that contained petroleum products (Tables 2.1 and 2.2) will be analyzed for the aromatic volatile organics BTEX following EPA procedure SW-846-8020 (EPA, 1986). Materials from gasoline tank excavations will be analyzed for TPH following EPA procedure SW-

846-8015, modified for petroleum analyses (EPA, 1986). Excavation materials from tanks that contained fuel oil will be analyzed for heavy petroleum hydrocarbons utilizing the TPH method developed and published by the California Department of Health Services (California State Water Resources Board, 1988). This method has been approved by EPA Region X and the IDH&W-DEQ for petroleum analysis. Analyses with EPA method numbers will be performed according to guidelines specified in SW-846, *Test Methods for Evaluating Solid Waste*, (EPA, 1986).

4.2.2 Tanks Containing Hazardous Constituents Other than Petroleum

Backfill and soil associated with tanks that contained hazardous constituents other than petroleum will be analyzed for those specific hazardous constituents quantified by laboratory analysis. The TCLP, Appendix I of 40 CFR 268 (CFR, 1989d), will be used where appropriate, followed by the analytical methods used to characterize the tank contents. Excavation materials associated with tanks that contained petroleum products (and other hazardous constituents) also will be analyzed for those constituents.

To date only one tank, TAN 1705 has been shown to contain hazardous constituents other than petroleum by laboratory analysis. The contents of TAN 1705 will be classified as a hazardous waste before removal. Excavation materials associated with this tank will be analyzed for BTEX and TPH as described above. In addition, the excavation materials will be analyzed for barium by ICP analysis (SW-846-6010) after TCLP extraction (EPA, 1986).

4.3 Action Levels

Action levels for contamination status are assigned for field screening activities and for laboratory analytical results. Field screening action levels for petroleum products in excavation materials are set at 25 ppm VOC for gasoline type fuels (gasoline, hexone, and kerosene) and 50 ppm VOC for fuel oil. Laboratory action levels are set at 100 ppm BTEX and TPH for materials associated with gasoline type fuels and 1000 ppm BTEX and TPH for

materials associated with fuel oil tanks. The INEL TMP action levels are set at 80 ppm and 800 ppm, respectively.

Field action levels of VOCs are intended to approximate the laboratory levels of TPH. The field action level for materials associated with gasoline type fuels is conservatively set at 25% of the laboratory action level, or 25 ppm VOC. The field action level for VOCs for fuel oil must be set much lower than 25% of the maximum TPH level to account for decreased volatility of the fuel oil compared to gasoline. The field action level for materials potentially contaminated with fuel oil is set at 50 ppm VOC.

The cleanup action level for hazardous organics other than petroleum constituents will be set at three times the MDL as specified in SW-846 (EPA, 1986) or as determined by the analytical laboratory. This action level has been mandated by EPA Region X and the IDH&W-DEQ.

To perform action level comparisons for metals, valid tolerance limits must be determined. The action level for metals will be defined as the one-sided upper tolerance limit corresponding to the 95th percentile of the background population with 95% confidence. This means that the calculated action level will be greater than 95% of the values in the background population with 95% confidence. This limit, U , is calculated from the mean, $\bar{x}$, and the standard deviation, s , of the background samples as $U = \bar{x} + ks$, where k is the tabled value corresponding to the 95th percentile with 95% confidence. A loose interpretation of this statistic is that if a sample value exceeds the value of U , then there is less than a 5% chance that the sample is from background; and hence, the sample is likely to be contaminated.

If tank constituents detected during the sampling and analysis are determined to be below the action level, then the site will be considered uncontaminated by that particular analyte. Concentrations above the action levels would indicate that RCRA remedial activities or additional site characterization may be necessary.

5. SAMPLE EQUIPMENT AND PROCEDURES

Samples will be collected directly from the heavy equipment bucket or from the excavated material after the material is placed outside of the excavation. The environmental sampler will direct the heavy equipment operator to select the areas of the excavation to be sampled based on the probable areas of contamination outlined in Section 4 of this document.

5.1 Sample Collection

Samples collected for field screening and for laboratory analysis require different sampling protocol. Table 5.1 lists the equipment needed for the collection of field and laboratory samples.

Table 5-1. Equipment list for UST closures or replacements

Microtip Photoionization Detector
Stainless steel sampling spoons
250-mL wide mouth I-Chem bottles
40-mL I-Chem vials with Teflon lined caps
HPLC grade organic free water
Ziplock pint size bags
Ziplock quart size freezer bags
Parafilm
Cooler
Blue ice packs, frozen
Vermiculite
Large, heavy-duty plastic bags
Strapping tape
Chain-of-custody forms
Chain-of-custody seals
Clear tape
Safety shoes
Safety glasses
Gloves

5.1.1 Sample Collection for Field Screening

Samples for field screening will be collected with a decontaminated stainless steel soil spoon and placed in a ziplock soil sampling bag before analysis with the precalibrated Microtip PID. Selected material will be scooped into the bag until the bag is 50% full. The bag will then be sealed and set in a warm place (in the sun or heated vehicle) for approximately 10 to 15 min to encourage contaminant volatilization. The sample bag will then be punctured with the vacuum tube of the Microtip PID. An air sample from the bag will be drawn through the Microtip and across the lamp of the PID.

The VOC concentration is shown on a continuous digital readout display. The maximum VOC concentration reading from the Microtip PID will be recorded in the logbook along with the field screening sample identification number. Sample identification numbers and sampling scheme are described in detail in Section 6.

5.1.2 Sample Collection for Laboratory Analysis

Sample collection locations will be selected from areas that have the highest probability of contamination evidenced by field screening and relationship to tank location. A decontaminated stainless steel soil spoon will be used to completely fill a 250-mL glass I-CHEM jar. Air spaces will be minimized without packing the sample. The lid will be replaced immediately, and parafilm will be wrapped around the junction of the lid and the jar to reduce loss of volatile organics from the sample. The sample will be properly labelled (Section 6) and placed in a sample bag in preparation for shipment.

A subsample will be collected for a field measurement of VOCs. This provides field evidence of volatile organic concentrations along with a check on the comparability of field and laboratory instrumentation.

5.2 Equipment Decontamination Procedures

To avoid sampling equipment cross contamination, clean sampling spoons will be used for each sample collected. The used spoons will be stored for decontamination in an onsite laboratory.

The decontamination procedure involves washing the spoons in warm, phosphate-free soapy water. The washed spoons are rinsed of all soap and clinging materials with tap water. The tap-rinsed spoons are rinsed with distilled, deionized water and then rinsed with pesticide grade methanol to remove any organics. The decontaminated spoons are allowed to air dry and wrapped in aluminum foil for storage until the next sampling event.

The rinsate blank, when required, is collected by rinsing the spoon with deionized water after allowing the spoon to air dry. The rinsate blank is only required for sample analysis for hazardous constituents.

The used methanol will be disposed of in the laboratory where the equipment was decontaminated. Prior arrangements will have been made with the laboratory to accept the small quantities of methanol generated from the decontamination process.

6. SAMPLE HANDLING AND ANALYSIS

The following sections summarize document management and sample control. Documentation includes all field documents used to record field data and document sampling procedures.

6.1 Sample Documentation

The field sampling team member is responsible for the control and maintenance of all field documents and records, and for ensuring that all required documents are submitted to Administrative Records and Document Control (ARDC). Sample documents include the sample labels, field logbooks, and chain-of-custody (COC) forms.

6.1.1 Sample Labels

Preprinted sample labels will be supplied by the ARDC. Labels will include preprinted information on the sample identification number (Section 6.1.3), the tank identification code, and the analysis type. Sample information collected in the field (date and time) will be written on the label with permanent black ink once the label is applied. Figure 6-1 contains an example of a sample label.

6.1.2 Sample Container Tag

A tag will be attached in the field to each sample container using a rubber band. Pre-printed sample tag information includes the sample identification number, tank identification code, analysis type, and preservation type. The date and time of the sampling will be recorded in the field. Figure 6-2 contains an example of a tag.

SAMPLE ID NUMBER: UB000	TIME:

DATE(ddmmyy):	SAMPLER:

ANALYSIS: BTEX + TPH	

FIELD MEASUREMENT/HAZARDS: VOCs	

Figure 6-1. Example of a sample container label.

AREA: Borax 000		

ANALYSIS:	DATE: (ddmmyy)	TIME:
BTEX + TPH		

SAMPLE ID NUMBER: UB000		

Figure 6-2. Example of a sample tag.

6.1.3 Sample Identification Number

A systematic eight- or nine-character code will be used to number the samples. The first two characters of the code are alphabetical; the first being a U for UST Program and the second being a one character code for the facility. The next three characters are numerical and represent the sample location numbers used in the ARDC database. The list of all sample location identification numbers used for site assessments during tank closure or replacement (expressed as a range) are listed by tank identification number in Tables 4-1 and 4-2. The sixth and seventh characters are also numerical and refer to the sequence number for multiple sample collection at one location. The last one to two characters are alphabetical and are used to identify the analysis and bottle type.

Tables 6-1 through 6-4 contain an example sampling and analysis plan table for each analysis type. The plan tables also illustrate the nine-character sampling code and how the code is derived. Sampling and analysis plan tables will be completed for each site assessment. Plan tables contain all the information necessary to fill out tags and labels. Plan tables will be submitted to the ARDC at least three weeks before to the scheduled tank closure or replacement activity.

Twenty sample location numbers were reserved for each tank location to ensure that sufficient sequential numbers were available for any additional sampling required at the site (Tables 4-1 and 4-2). Many of the higher numbers in the sample identification code range will remain unused during site assessments of tanks that exhibit no detectable contamination.

6.1.4 Field Logbooks

Field logbooks will be used to record information necessary to interpret analytical data and prepare the closure site assessment report. All information collected in the field pertaining to sampling activities will be entered into the correct logbook in permanent black ink. Any errors will be

Table 6-1. Example sampling and analysis plan table for the site assessment of a gasoline UST

[illegible]

Descriptions for analysis type fields

Comments

IT1 : IPH by DHS Method and BTEX by SW-846-8020

UA00202T2 is a Duplicate of UA00201T2

IT2 : TPH by SW-846-8015 and BTEX by SW-846-8020

Sample locations may be less than 10.

Table 6-2. Example sampling and analysis plan table for the site assessment of a fuel oil UST

[illegible]

Descriptions for analysis type fields

Comments

II: TPH by DHS Method and BTEX by SW-846-8020

UC04102T1 is a Duplicate of UC04101T1

TPH by SW-846-8015 and BTEX by SW-846-8020

Sample locations may be less than 10.

Table 6-3. Example sampling and analysis plan table for the site assessment of UST with elevated barium

Sampling Date:		UST Number/Type TAN 1705 / Lube Oil with elevated Metals									
Sample Description			Sample Location		Analysis Types Requested						
Sample Number	Sample Type	Media	Coll Type	Tank #	Collection Location	T1	T2	V0	SE	ME	OA1 OA2 OA3
UT000	Reg	Soil	Grab	TAN1705	Excavation	1				1	
UT001	Reg	Soil	Grab	TAN1705	Excavation	1				1	
UT002	Reg	Soil	Grab	TAN1705	Excavation	2				2	
UT003	Reg	Soil	Grab	TAN1705	Excavation	1				1	
UT004	Reg	Soil	Grab	TAN1705	Excavation	1				1	
UT005	Reg	Soil	Grab	TAN1705	Excavation	1				1	
UT006	Reg	Soil	Grab	TAN1705	Excavation	1				1	
UT007	Reg	Soil	Grab	TAN1705	Excavation	1				1	
UT008	Reg	Soil	Grab	TAN1705	Excavation	1				1	
UT009	Reg	Soil	Grab	TAN1705	Excavation	1				1	
UT010	BKGD	Soil	Grab	TAN1705	Background					1	
UT011	BKGD	Soil	Grab	TAN1705	Background					1	
UT012	BKGD	Soil	Grab	TAN1705	Background					1	
Sample Label Codes											
UT00001T1, UT00001ME											
UT00101T1, UT00101ME											
UT00201T1, UT00202T1, UT00201ME, UT00202ME											
UT00301T1, UT00301ME											
UT00401T1, UT00401ME											
UT00501T1, UT00501ME											
UT00601T1, UT00601ME											
UT00701T1, UT00701ME											
UT00801T1, UT00801ME											
UT00901T1, UT00901ME											
UT01001ME											
UT01101ME											
UT01201ME											

Descriptions for analysis type fields

T1: TPH by DHS Method and BTEX by SW-846-8020

T2: TPH by SW-846-8015 and BTEX by SW-846-8020

ME: Metals by ICP analysis (SW-846-6010) after TCLP extraction

Comments

UT00202T1 and UT00202ME are Duplicates of UT00201T1 and UT00201ME

Sample locations may be less than 10.

Table 6-4. Example sampling and analysis plan table for the site assessment of UST with elevated chlorinated hydrocarbons

Sampling Date: _____ UST Number/Type CFA 763/ Used Oil with elevated Chlorinated Hydrocarbons													
Sample Description				Sample Location		Analysis Types Requested						Sample Label Codes	
Sample Number	Sample Type	Media	Coll Type	Tank #	Collection Location	T1	T2	V0	SE	ME	OA1	OA2	OA3
UC440	Reg	Soil	Grab	CFA763	Excavation	1		1					UC44001T1, UC44001V0
UC441	Reg	Soil	Grab	CFA763	Excavation	1		1					UC44101T1, UC44101V0
UC442	Reg	Soil	Grab	CFA763	Excavation	2		2					UC44201T1, UC44202T1, UC44201V0, UC44202V0
UC443	Reg	Soil	Grab	CFA763	Excavation	1		1					UC44301T1, UC44301V0
UC444	Reg	Soil	Grab	CFA763	Excavation	1		1					UC44401T1, UC44401V0
UC445	Reg	Soil	Grab	CFA763	Excavation	1		1					UC44501T1, UC44501V0
UC446	Reg	Soil	Grab	CFA763	Excavation	1		1					UC44601T1, UC44601V0
UC447	Reg	Soil	Grab	CFA763	Excavation	1		1					UC44701T1, UC44701V0
UC448	Reg	Soil	Grab	CFA763	Excavation	1		1					UC44801T1, UC44801V0
UC449	Reg	Soil	Grab	CFA763	Excavation	1		1					UC44901T1, UC44901V0
UC450	Rinsate	Water	QC	CFA763	Blank			3					UC45001V0
UC451	Trip	Water	QC	CFA763	Blank			3					UC45101V0

Descriptions for analysis type fields		Comments
T1:	IPH by DHS Method and BTEX by SW-846-8020	UC44102T1 and UC44102V0 are duplicates of UC44101T1 and UC44101V0.
T2:	IPH by SW-846-8015 and BTEX by SW-846-8020	Sample locations may be less than 10.
V0:	VOAs by SW-846-8240 after ICPLP extraction	

corrected by drawing a single line through the error and entering the correct information. Entries will be dated and signed by the individual making the entry.

6.1.4.1 Sample logbooks. Sample logbooks are used to record descriptions of all activities pertinent to the sampling activities. Such entries will include a hand-drawn map of the site indicating sample locations, data from the field screening activities, estimates of the volume of backfill removed, disposition of the backfill, and any other necessary information. The serial number or ID number and disposition of all controlled documents (chain-of-custody forms) will be recorded in the sample logbook. Figure 6-3 contains a sample of a sampling team activity sheet, and Figure 6-4 contains examples of sample log sheets.

6.1.4.2 Equipment calibration logbook. Each piece of analytical field equipment will have a logbook to record the specific calibration data. Specific data include calibration procedure, date of calibration, name of equipment operator, and any peculiarities in equipment operation.

6.2 Sample Handling

Tables 6-5 and 6-6 outline the typical requirements for containers, preservation methods, sample volumes, and holding times for solid and aqueous samples.

6.2.1 Sample Containers

All laboratory sample containers will be precleaned and obtained from I-Chem, an EPA-approved supplier for Superfund sites. Extra containers will be available in the event of breakage, contamination, etc.

No contaminated sample containers will be reused. Containers will be disposed of onsite or at the laboratories. Onsite disposal will be coordinated with site waste disposal personnel.

SAMPLE LOGSHEET					
DATE(DD/MM/YY):		LOCATION:			
SAMPLE TYPE: (0) Normal (1) Equip. Blank (PRIOR) (2) Trip Blank (3) Replicate (4) Split (5) Equip. Blank (POST) (6) Spike (7) Other					
ID NO.:	CODE	ID NO.:	CODE	ID NO.:	CODE
SPECIFIC SAMPLING POINT(S)/LOCATIONS AND DEPTH:		POINT (LOCATION)	DEPTH FROM	TO	(UNITS) BELOW SURFACE
SAMPLE METHOD: CODE: ()					
(0) Grab (1) Spatial Comp. (2) Time Comp. (3) Other					
SAMPLE DESCRIPTION: CODE ()					
<u>SOIL/ROCK</u>		<u>SEDIMENT/SLUDGE</u>		<u>LIQUIDS</u>	
(00) Surf. Soil		(01) Pond/Impoundment		(08) Pond/Impoundment	
(01) Sub. Surf. Soil		(06) Drum/Tank		(09) Drum/Tank	
(02) Basalt		(07) Other		(10) Plant Discharge	
(03) Sediment Interbed		<u>AIR/GAS</u>		(11) Spring/Seep	
(04) Other		(15) Soil Gas		(12) Perched Aquifer	
		(16) Other		(13) Regional Aquifer	
Other:				(14) Other	
(list field measurements of the samples)					
<u>FIELD MEASUREMENTS:</u>	Units	Instr. Make/Model	Instr. No.:		
pH:					
temperature:					
SAMPLING AND ANALYSIS PLAN FOLLOWED: NO () YES () IF NO EXPLAIN DEVIATIONS:					
RECORDED BY:			QA CHECK BY:		

Figure 6-4. Sample log sheet (page 1).

SAMPLE LOGSHEET

[illegible]

RECORDED BY: _____ QA CHECK BY: _____

Figure 6-4. Sample log sheet (page 2).

SAMPLE LOGBOOK	
MAP OF SAMPLING LOCATION: (include location of sampling points and reference points)

RECORDED BY: _____	QA CHECK BY: _____

Figure 6-4. Sample log sheet (page 3).

Table 6-5. Sample requirements for soils and sediment

Analytical Parameter	Container		Preservative	Holding Time ^a	Sample Volume
	Size	Type			
BTEX/TPH	250 mL	(WM) Glass Jar with Teflon Liner	4°C	14 days	100 g (minimum headspace)
TCLP Extractable Organics	1000 mL	Amber Glass Jar	4°C	7 days to TCLP ext. 7 days to prep ext. 40 days to analysis	100 g per parameter
TCLP Volatile Organics	250 mL	(WM) Glass Jar with Teflon liner	4 C	14 days to ZHE 14 days to analysis	50 g (minimum headspace)
TCLP Metals	500 mL	(WM) Glass Jar	4°C	180 days to TCLP ext. 180 days to analysis except Hg, which is 28 days to TCLP ext. 28 days to analysis	75 g

^a Holding times are from the date of collection as referred to in the Federal Register Vol 55, No. 61, March 29, 1990.

Table 6-6. Sample requirements for aqueous (QC) samples

Analytical Parameter	Container		Preservative	Holding Time ^a	Sample Volume
	Size	Type			
Volatile Organics/Hydrocarbons	120 mL	3, 40 mL vials with Teflon lined septum	4°C	14 days	5 mL
TCLP Extractable Organics	4000 mL	Amber Glass Jar	4°C	7 days to ext. 40 days to analysis	1000 mL
TCLP Volatile Organics	120 mL	3, 40 mL vials with Teflon lined septum	4°C	14 days to analysis	5 mL
TCLP Metals	250 mL	(VM) Glass Jar	4°C	180 days to analysis except Hg, which is 28 days to analysis	75 g

^a Holding times are from the date of collection as referred to in Federal Register Vol. 55, No. 61, March 29, 1990.

Sample bottles for volatile organic analysis will be filled to allow minimal headspace. The 40-mL glass VOA vials will be filled completely with absolutely no headspace or air bubbles. Soil samples collected in 250- and 500-mL jars will be filled to capacity.

6.2.2 Chain-of-Custody Procedures

Chain-of-custody (COC) procedures will begin immediately after sample collection. Before mobilization of the sampling team, sample containers will be stored in a secured room with custody seals placed on the outside of each box of containers. COC procedures will be followed, as outlined in Section 4.6.3 of *A Compendium of Superfund Field Operations Methods* (EPA, 1987b). Chain-of-custody forms (Figure 6-5) will be initiated the day of sample collection. Parafilm will be wrapped around the neck and lid of the container to secure the lid. The secureness of the lids on the containers will be checked before shipping the sample to the analytical laboratory.

6.2.3 Sample Preservation

Ice chests will be used to chill samples during field sampling, packaging, and shipment. Blue ice will be placed in the ice chest to keep the samples cool during collection, overnight storage, and shipment. Before shipment, the inside temperature of the ice chest will be measured by thermometer and recorded in the sampling logbook.

Preservation of aqueous QA/QC samples will follow procedures outlined in Table 6-6. Aqueous QA/QC samples will be collected only when samples are analyzed for hazardous constituents other than petroleum.

6.2.4 Transportation of Samples

All samples will be shipped "priority one/overnight" via Federal Express through the Federal Express Office in accordance with the regulations issued

[illegible]

Original and Pink cones accompany sample shipment to laboratory

Original copy retained by custodian

Pink copy retained by laboratory

Yellow copy retained by sampler

Figure 6-5. Example of a chain-of-custody form.

by the Department of Transportation, 49 CFR 171 through 179 (CFR, 1989e), EPA sample handling, packaging, and shipping methods, 40 CFR 261.C.3C.3 (CFR, 1989b) and procedures outlined in ERP Program Directive 6.1 (EG&G, 1989b).

All samples will be packaged and transported in a manner that protects the integrity of the sample and prevents sample leakage. Samples will be placed in an ice chest with adequate blue ice to maintain the 4°C preservation temperature and with adequate vermiculite to insulate the samples from shifting during transportation.

6.2.4.1 Field Radiation Screening Procedures. Qualified EG&G Idaho personnel (Health Physics) will perform sample radiation screening in the field for shipping purposes. All sample screening will be performed using hand held instruments that have been properly calibrated before field use. A green tag will be issued by the Health Physicist for samples determined to be nonradioactive (at or below background). The green tag will accompany the samples until shipment offsite.

6.2.4.2 Custody Seals. Custody seals will be placed on all shipping containers. Clear, plastic tape will be placed over the seals to ensure that they are not accidentally broken during shipment.

6.2.4.3 Onsite Shipping. An onsite shipment is any transfer of material within the perimeter of the INEL. Site-specific requirements for transportation of samples within site boundaries and those required by the shipping/receiving department will be followed. Shipments within INEL boundaries will conform to DOT requirements, as stated in 49 CFR 171 through 179 (CFR, 1989e).

6.2.4.4 Approvals Needed for Transportation of Samples. Transportation of hazardous samples both onsite and offsite will be coordinated with EG&G Idaho shipping personnel. These arrangements will be made before the onset of field sampling activities. Transportation of radioactive or hazardous samples is not anticipated to be a regular activity.

7. EQUIPMENT

The field sampling equipment list is found in Table 5-1. Required laboratory equipment are listed in the appropriate analytical procedures. Sampling and analytical equipment will be calibrated, operated, and maintained in the following manner.

7.1 Equipment Calibration

Field and laboratory instrumentation will be calibrated as per manufacturer's instructions and Standard Operating Procedures (SOPs). The portable Microtip PID will be calibrated daily before sample collection. Calibration of portable radiation detection instruments will follow procedures outlined in the EG&G *Radiological Controls Manual* (EG&G, 1989c). A logbook of instrument and equipment calibration and maintenance will be kept and controlled by the field sampling team leader.

Laboratory instrument calibration will follow procedures outlined in SW-846 (EPA, 1986) for organic and inorganic chemical analyses.

All calibration standards, including internal standards and surrogate standards, are obtained from chemical suppliers with certification of high purity and concentration. The standards are routinely checked by the laboratory for traceability to National Institute of Standards and Technology (NIST). Standard Reference Materials (SRMs) are used as stock standards. Working standards are made to cover the linear range of the calibration curve. The working standards are used for initial calibration curves, continuing calibration checks, and preparation of analyte spiking solutions.

7.2 Equipment Maintenance and Operation

Instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with specified recommendations of the manufacturers and the written procedures developed by the operators.

7.2.1 Field Equipment

Operational checks will be made on all field equipment. Operational checks involve inspecting the physical condition of each piece of equipment, the battery and instrument response, and ensuring proper instrument calibration.

The Microtip PID will be checked periodically for proper operation. Operation checks will be recorded in the calibration logbook.

Portable radiological instrumentation must pass a source check performed within the week preceding field use. The instrument shall be checked to respond to a known source. Instrument response shall be within 20% of the expected reference reading. Results of this weekly operational check shall be recorded by the Health Physics personnel and kept with the instruments.

7.2.2 Laboratory Equipment

The analytical laboratory will have to maintain records of equipment calibration and maintenance. The analytical laboratory selected will have to be audited and approved by ERP Site Characterization Personnel.

7.3 Decontamination

Procedures will be followed that will prevent or minimize contamination. These procedures will enhance the integrity and quality of the samples. Decontamination procedures are discussed in greater detail in Section 5.4.

8.0 ANALYTICAL PROCEDURES

Laboratory analysis requirements are listed in the Statement of Work (ERP, 1990). Laboratory analytical procedures will follow EPA approved methods. Procedures for BTEX and hazardous constituent analysis are described in *Test Methods for Evaluation of Solid Waste* (EPA, 1986).

8.1 Analysis of Petroleum Constituents

All excavation materials associated with petroleum tanks will be analyzed for BTEX following SW-846-8020. The analytical method for TPH in excavation materials associated with tanks that contained gasoline type fuels follows SW-846-8015, modified for petroleum analysis. The analytical method for TPH analysis of excavation materials associated with tanks that contained fuel oil follows the procedure developed by the California Department of Health Services (California State Water Resources Control Board, 1988). These analytical methods were adopted and approved by EPA Region X and the IDH&W-DEQ.

8.2 Analysis of Hazardous Constituents other than Petroleum

Excavation materials associated with tanks that contained hazardous constituents other than petroleum will be analyzed for those specific compounds. The TCLP, Appendix I of 40 CFR 268 (CFR, 1989d), will be used to extract the samples, followed by the analytical methods used to characterize the tank contents. Where applicable, analysis of inorganics (SW-846-6010), volatile organics (SW-846-8240), and semivolatile organics (SW-846-8270) will be used to assess contamination concentrations in excavation materials (EPA, 1986).

9. DATA REDUCTION, VALIDATION, AND REPORTING

The protocol for data reduction, validation, and reporting will be outlined in this section. The data package used for the preparation of the final report will contain all the information necessary to ensure defensible data to comply with regulations governing USTs.

9.1 Data Reduction

Data reduction refers to computations and calculations performed on data, as defined by the *Data Collection Quality Assurance Plan for the Buried Waste Program* (EG&G, 1988). This includes computing summary statistics, standard errors, confidence limits, tests of hypothesis relative to the parameters, and model validation. Standard equations and statistically acceptable procedures will be used. When appropriate, data will be reported with statistically supported limits of uncertainty to indicate limitations on the use of the data. All data, when reported, will be rounded to the number of significant figures consistent with the confidence limits. Confidence limits will be justified by the accuracy and precision of the sampling measurement and the analytical method.

Laboratory data reduction will be addressed in the Underground Storage Tank Removal Statement of Work (ERP, 1990) issued to the analytical laboratory. All bench chemists will document sample preparation activities in a bound laboratory notebook, which will serve as the primary record for subsequent data reduction. Final data reduction of analyses performed will be the responsibility of the individual compiling the final report. Results from each data collection activity will be reported in consistent units throughout each task. Data from different tasks will be compared using statistical methods that will be described when the data is presented. When applicable, as when presenting data on contaminant concentrations, any applicable state or federal regulatory limits will be presented with the analytical data.

Adequate site characterization to comply with 40 CFR 280 (CFR, 1989a) involves the collection of three or more samples from discrete locations.

Sample analytical data for each discrete location will be reported. Summary statistics will not be performed on routine samples collected for analysis of petroleum contamination. Summary statistics will be employed when the excavation exhibits contamination indicated by field screening, and the number of samples collected for laboratory analysis exceeds ten.

Background sample data (inorganic analyses) will require summarization for comparison to excavation conditions. Extensive sample analyses for hazardous constituent characterization also will require data summarization, as mentioned above.

9.2 Method Data Validation

Method data validation/qualification is the process by which a sample measurement, method, or piece of data is deemed useful for a specified purpose. The appropriate EPA functional guidelines will be followed for chemical analyses method validation/qualification. The analytical Standard Operating Procedure (ERP, 1990) for UST site assessments will specify information and guidance specific to the samples to be analyzed and data reporting forms to be used. The data reporting forms will be reviewed as part of the data validation process to verify that the proper information is complete and correct.

The data flow process is illustrated in Figure 9-1. The process begins when a sampling and analysis database is developed for the project. Sample labels and tags are developed by data management personnel using this data base. Selected field data will be used by data management for producing summary tables of field and analytical data.

When data management personnel receive a data package, the next step in the process is preparation of the package for data entry via the computer program, followed by data entry with automated error checks of the data. The data management staff decide if the package has sufficient completeness and accuracy for entry into the data management system (DMS) and report to the

Figure 9-1. Integrated chemical data flow process.

project manager. The process commonly results in a need to procure additional data or clarification from the lab that performed the analyses, before the data is entered. For example, a data package cannot be entered with the proper linkage maintained for records if sample numbers are used inconsistently throughout the data package. Once the package is deemed adequate, it is entered into the DMS.

Concurrent with data entry, an automated routine is invoked that performs a set of checks on the data as part of the data verification and validation (V/V) process. A listing of suspect data entries (errors) is printed to an output file; then an attempt is made to resolve each error. First, a check is made to determine if the error resulted from data entry. Other attempts are made to resolve the errors and when the effort is successful, the data forms and data bases are modified to reflect any changes.

A listing of the residual set of errors is made and each error is highlighted on the applicable data form. The data entry clerk visually verifies the data through comparison of data on the original data forms and data on electronically produced forms, the latter originating from the data base created in the data entry process. The next step in the V/V process is generating QC tables. The QC tables provide an efficient, easily readable tabular presentation of all data included on the complete set of data forms. The QC table is part of a package of information that is then forwarded to an analytical chemist who performs the next step of the data V/V. The package includes the following:

- Raw analytical data (if applicable)
- Original data forms
- Electronically reproduced data forms
- Error file output
- Contract compliance screening (CCS) output (if applicable)
- QC table.

The chemist continues the data quality assessment using the set of information previously identified. The chemist attempts to resolve

deficiencies identified in the error file listing. Concurrently, the chemist reviews the raw data to assess whether the analysis was performed per the specifications for the underlying analytical method and that data on the reporting forms is consistent with the raw data. All laboratory data will be cross-referenced to the appropriate trip blank, field blank, rinsate (equipment blank), method blank, field duplicate or replicate, matrix spike, and matrix spike duplicate. Cross-referencing must include reference samples that have known concentrations for elements of interest. In addition, all pertinent data (data collected, received by the laboratory, and analyzed) for each laboratory analysis will be referenced against their respective hold times.

After a chemist's evaluation and a Data Limitations and Qualifications (L&Q) report has been produced, the modified data forms are resubmitted to the data management staff. The L&Q report is written after a thorough examination of the data, QC tables, and the CCS defect statements. The L&Q report will state if the data is usable at the analytical level requested in the SOW (ERP, 1990) and will define any flags used in the method validation/qualification process. The L&Q report, together with the QC tables and the CCS defect statements, will allow customer-effective use of the data. Figure 9-2 is a diagram of the ERP chemical analyses data validation and qualification process.

9.3 Data Reporting

Field data reporting procedures and formats are specified in Section 6 in this SAP. Laboratory data reporting will follow the procedures and format specified in the UST Removal SOW (ERP, 1990). Results and QC data for each analysis will be transcribed onto analytical reporting forms specific to the particular analysis. These forms will be provided in the analytical SOW (ERP, 1990). All data will be checked for accuracy and precision at the bench and instrument operator/analyst level and the laboratory manager's level before submitting the data package to EG&G Idaho.

Figure 9-2. ERP chemical analyses data validation and qualification process.

9.4 List of Required Data

The following is a list of information that is required on all samples to complete a Data Qualification Package. The listed information is described in the *Buried Waste Programs Data Qualification Manual* (EG&G, 1989d).

9.4.1 Chemical Analysis Data

The list of required information for organic analyses differs from the list of required information for inorganic analyses. The information is therefore listed separately in the following sections.

9.4.1.1 Level II VOC Analysis. Field screening for VOC concentrations will require the use of a PID. The Photovac Microtip PID will be used to screen excavation materials, and to record field VOC concentrations of subsamples shipped to the laboratory for Level III analysis. Analytical requirements for the collection of Level II field data are as follows:

- Sampling Information
 - Copies of calibration logbook pages
 - Sample number(s)
 - Sample location
 - Sample date and time
 - Field duplicates.
- Analytical Information
 - VOC concentration displayed on digital readout for each sample
 - Description of any anomalous field readings.

9.4.1.1 Level III Organic Analyses. Organic analyses will be performed for the volatile aromatic organics BTEX (EPA method 8020) and TPHs (EPA method

8015 or DHS method). Other organic analyses may be required for analysis of specific hazardous constituents. Each organic data qualification package will include the following:

- Data Quality Objectives
- Sampling Information
 - SAP reference
 - DOP and/or SOP reference
 - Logbook reference or copies of applicable pages
 - Copies of calibration logs
 - Sample number(s)
 - Sample location
 - Sample date and time
 - Field duplicates
 - Field spikes
 - Field blanks
 - Copies of QC reports
 - Chain-of-custody
 - Storage and shipping requirements.
- Contract Requirements and EG&G Statement of Work or Reference
- Analytical Information
 - Analytical summary
 - lab name
 - date and time samples were analyzed
 - analytical method or procedure reference
 - type of instrumentation used
 - description of analytical problems encountered and internal decisions applied
 - summary of sample preparation procedure (lab notebook reproduction or bench sheets) including addition of surrogate and/or matrix percent recovery information.
 - Quality control summary
 - surrogate recoveries
 - reagent blank analyses
 - matrix spike and matrix spike duplicate recoveries
 - instrument tuning and performance information.
 - Sample data

- sample size (aqueous samples in mL, others in grams)
 - matrix (water, soil, or others)
 - tabulated results of all required organic compounds
 - assigned data qualifiers
 - established method detection limits
 - reported concentration in $\mu\text{g/L}$ (water) or $\mu\text{g/kg}$ (soil, sludge, or other).
- Raw sample analytical data
 - sample chromatograms
 - sample spectra
 - standard spectra for positive qualitative sample results
 - quantitation reports
 - calculations.
 - Standards data package
 - standards chromatograms
 - data system printouts
 - initial calibration summary forms
 - continuing calibration summary forms.
 - QC data package
 - GC/MS instrument tunes for both volatile and semivolatile compound analyses (spectra and tables of m/z versus relative abundance)
 - addition of surrogate compounds to each sample and blank for determining percent recovery information
 - matrix spike and matrix spike duplicate analyses (including all information required for sample data and raw sample analytical data).
 - Data review
 - analytical chemist review report
 - computerized QC checks
 - established uncertainties
 - DIRC report.

9.4.1.2 Level III Inorganic Analyses.

Level III analyses for inorganic compounds will be for metals in soil samples. The EPA summary forms for inorganics will not be required but may be used to summarize the lab analysis. The following information will be included in the data qualification package:

- Data Quality Objectives
- Sampling Information (same as for Organic Analyses)
- Contract requirements or reference
- Analytical information.
 - Analytical summary
 - lab name
 - date and time samples were analyzed
 - analytical method or procedure reference
 - type of instrumentation used.
 - Cover letter
 - listing of samples
 - comments describing problems encountered in analysis.
 - Tabulated results
 - inorganic compounds identified and quantified
 - reported in $\mu\text{g/L}$ or mg/kg .
 - QC samples
 - initial calibration verification
 - continuing calibration verification
 - ICP interference check sample analysis
 - preparation blank analysis
 - matrix spike analysis
 - duplicate sample analysis
 - laboratory control sample analysis.
 - Raw data system printouts
 - calibration standards
 - calibration blanks
 - preparation blanks

- samples and any atypical dilution
- duplicates
- spikes
- interference checks
- instrument adjustments.

9.5 Uncertainty Analysis

Uncertainty measurements will be assigned to all chemical contaminant concentration data. For chemical analysis under SW-846 (EPA, 1986), historical precision and accuracy measures for the water matrix will be used as uncertainties.

The uncertainty measure assigned to each concentration will be given by $\pm U$ where

$$U = (B^2 + 4S^2)^{1/2}$$

and

$B = \% \text{ Bias} = \% \text{ Recovery} - 100$

$S = \% \text{ Relative standard deviation (RSD)}.$

The calculation of % Recovery and % (RSD) is discussed in Section 12. For the standard analysis techniques (i.e., those done under SW-846), historical values will be used if the laboratory is in control.

10. INTERNAL QUALITY CONTROL

Quality assurance/quality control (QA/QC) measures differ for field and laboratory activities, and are therefore addressed separately.

10.1 Field QA/QC

Internal QC checks are established by submitting QC samples to the analytical laboratory. The number of field quality control samples is approximately 5% of the total number of field samples taken. The types and frequency of collection for field quality control samples are provided below:

- Trip Blanks are defined as samples that originated from HPLC-grade organic free water sent to the laboratory with the volatile organic analysis (VOA) samples. One trip blank shall accompany each cooler containing VOA samples. Trip blanks are stored at the laboratory with samples and analyzed only for VOCs. The results of the trip blank analyses will help determine the level of contamination introduced to the sample during shipping, handling, and storage.
- Rinsates (equipment blanks) are defined as the final analyte-free water rinse from equipment cleaning collected during a sampling event. The sample is analyzed for the same analytes as the samples that are collected that day. The results of the rinsate analyses will be used to flag or assess the level of analytes in the samples that enables evaluation of the decontamination process, the final rinse water, and the sample containers for contamination. Rinsate blanks will be collected during sampling activities for hazardous constituents.
- Field Replicates are defined as independent samples collected in such a manner that they are equally representative of the variables of interest at a given point in space and time. The laboratory uses the field replicate as laboratory replicates

and/or matrix spikes. Replicate samples provide an estimate of sampling precision.

10.2 Laboratory QA/QC

The daily quality of analytical data generated in the contracted analytical laboratories is controlled by the implementation of an Analytical Laboratory Quality Assurance Plan. Only laboratories approved by the Environmental Restoration Programs' QA will be used to conduct sample analysis as defined in this plan. The types of internal quality control checks are described below:

- Method Blanks: Method blanks usually consist of laboratory reagent grade water treated in the same manner as the sample (i.e., digested, extracted, distilled) that is then analyzed and reported as a standard sample would be.
- Method Blank Spike: A method blank spike is a sample of laboratory reagent grade water fortified (spiked) with the analytes of interest that is prepared and analyzed with the associated sample batch. Method blank spikes are not included with volatiles analyses since the same function is served by the calibration blank.
- Laboratory Control Sample for Inorganics: This is a standard solution with a certified concentration that is analyzed as a sample and is used to monitor analytical accuracy. (Equivalent to a method blank spike).
- Matrix Spikes: A matrix spike is an aliquot of an investigative sample that is fortified (spiked) with the analytes of interest and analyzed with an associated sample batch to monitor the effects of the investigative sample matrix (matrix effects) on the analytical method. Matrix spikes are performed only in association with selected protocols. Matrix spikes will be

performed on 5% of the samples (1 in 20) or one per batch of samples, whichever is greater.

- Laboratory Duplicate Samples: Duplicate samples are obtained by splitting a field sample into two separate aliquots and performing two separate analyses on the aliquots. The analysis of laboratory duplicates monitors sample precision; however, it may be affected by nonhomogeneity of the sample, particularly in the case of nonaqueous samples. Duplicates are performed only in association with selected protocols. Laboratory duplicates are performed on 5% of the samples (1 in 20) or one per batch of samples, whichever is greater.
- Known QC Check Sample: This is a QC sample of known concentration obtained from the U.S. EPA, the NIST, or a commercial source. This QC sample is to check the accuracy of an analytical procedure. It is particularly applicable when a minor revision or adjustment has been made to an analytical procedure or instrument.

10.3 Performance and System Audits

Evaluating the performance of activities in accordance with the QA plan will be the responsibility of the project manager, field team leaders, and analytical managers in conjunction with the appropriate QA Coordinators. Quality-related activities will be routinely inspected to ensure compliance with the QA plan. Internal inspections will be performed routinely and for specific activities. Significant deviations from the QA plan will be discussed with the project manager, QA coordinators, and affected personnel.

The first phase of an auditing program should be the preparation of checklists that identify the methods and techniques necessary to perform all aspects of the required audit. The checklists must be adequate to perform sampling (collection, field, and data management) audits. The second phase will then be the actual conduct of the required field audit. Audits are conducted at a frequency determined by the project manager. The final phase

will be the preparation of the QA Audit Report by the field and laboratory QA officers, which will be submitted to EPA.

10.3.1 System Audit

The system audit is an overall evaluation of the sampling project and it is performed to

- Verify that the sampling methodology is being performed in accordance with program requirements.
- Check on the use of appropriate QA/QC measures
- Check methods of sample handling (i.e., packaging, labeling, preserving, transporting, and archiving) in accordance with program requirements
- Identify any existing quality problems
- Check program documentation (Section 6)
- Initiate corrective action if a problem is identified
- Assess personnel experience and qualifications, if required
- Follow-up on any corrective action previously implemented
- Provide debriefings for sampling team personnel
- Provide a written evaluation of the sampling program.

The purpose of the system audit is to ensure that the QA/QC system planned for the project is in place and functioning properly.

The auditor must first review work plans, protocols, test plans, the QA/QC project plan, and all program reports. A discussion of the project status and problem identification with the project manager is suggested before conducting the onsite sampling audit. Sample procedures and raw data are checked, as appropriate. Spot checks are performed of sampling methods and techniques, sampling and analysis calculations, and data transcription.

10.3.2 Sample Collection Audits

An audit of the overall QA/QC plan for sample documentation, collection, preparation, storage, and transfer procedures will be performed within one week before the initiation of sampling. The intent of this audit is to critically review the entire sampling operation to determine the need for any corrective action early in the program. Additional total program or partial audits can be conducted at various times throughout the sampling program.

It is recommended that a Quality Assurance officer (QAO) perform unannounced site inspections to monitor the sampling team's activities, provide technical and corrective action suggestions to the sampling teams, and supplement sampling performance audits.

10.3.3 Field Audits

The primary objective of field audits is to determine the status of sampling operations. Emphasis is placed on the following activities:

- Verification that the operational aspects and procedures are in accordance with the protocols and the SAP
- Verification of sample collection, including duplicates and field blanks
- Verification that the documentation is in order and sufficient to establish the collection location of any sample collected
- Determination of existing discrepancies and initiation of corrective actions, as appropriate
- Allowing the QAO to direct the collection of independent samples.

The purpose of the onsite field audit is to inspect sample records and equipment. Records requiring inspection include the following:

- COC forms
- Sample tags
- Unit description forms
- Logbooks.

The operational inspection procedures include

- Sampling procedures
- Equipment
- Techniques
- Decontamination
- Collection of duplicate and field blank samples
- Security
- Sample storage and transportation
- Containers
- Contaminated waste storage and disposal
- Unit description form entries.

10.3.4 Data Management Audits

An audit should be performed of the data management system by tracing the flow of specific samples through the system. In particular, the system should be checked for its ability to allow correct identification of a sample from any stage of sampling and analysis. SAP information, field logbook information, and chemical data package deliverables will provide the basis for these performance checks. From time to time, input information may be used to audit the system.

10.4 Corrective Actions

Laboratory corrective action will be initiated, when required, to ensure data quality meets the criteria outlined in the laboratory QA plans.

Corrective action will be initiated when the project objectives are not met or when assessment of the data reveals questionable or unknown data quality.

Corrective action may be initiated by any individual on the project subject to approval by the project manager. These corrective actions will include but are not limited to

- Modifications of the sampling procedure
- Modifications of sampling design
- Modifications of analytical techniques within EPA-approved guidelines
- Modifications of data reporting procedures.

10.5 Quality Assurance Reports to Management

Quality Assurance reports to project management will be prepared for each sampling site. A monthly report on the performance of the quality assurance program will be prepared by the QAO and presented to the program manager. These reports will cover data quality assessment and results of internal performance inspections with corrective action recommendations and status, as necessary.

11. QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION, ACCURACY, COMPLETENESS, REPRESENTATIVENESS AND COMPARABILITY

The quality assurance objective for measurement data is to ensure that site characterization data are of known and acceptable quality. Data from laboratory analysis of site samples will be used for site assessments and hazard determination at the each UST removal or replacement site.

The quality assurance objectives for analytical data from the environmental samples collected were described in detail in Section 2. Descriptions for precision, accuracy, representativeness, comparability, and completeness are given below.

11.1 Precision

Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is assessed by means of laboratory duplicate/field replicate sample analysis. The laboratory objective for precision is to equal or exceed the precision demonstrated for similar samples, and shall be within the established control limits for the methods, as published by the EPA in SW-846, (EPA, 1986).

11.1.1 Field Precision

The field precision will be calculated using results of replicate samples as both the standard deviation and the percent relative standard deviation (% RSD). The standard deviation, s , is calculated from the variance, s^2 , as

$$s^2 = \frac{\sum (x_i - \bar{x})^2}{n - 1}$$

and

$$s = \sqrt{s^2}$$

The %RSD is then

$$\% \text{ RSD} = s/\bar{x} .$$

The standard deviation and % RSD are calculated for every contaminant measured.

11.1.2 Laboratory Precision

Precision of the chemical laboratory data will be measured through the use of the matrix spike/matrix spike duplicate (MS/MSD) samples and will be calculated as the % RSD.

11.2 Accuracy

Accuracy refers to the nearness of a result, or the mean of a set of results, to the true value. Accuracy is assessed by reference samples and percent recoveries. The laboratory objective for accuracy is to be within the established control limits for the methods as published by EPA in SW-846. Historical ranges for percent recoveries, for each analytical method, are stated in SW-846.

11.2.1 Field Accuracy

The success of sample analyses that accurately reflect the true concentration of a contaminant in the soil cannot be quantitatively assessed. However, the sampling locations and methods described in the SAP have been chosen such that the resultant samples should be representative of the media sampled.

Sample contamination yields inaccurate results. Where appropriate, rinsate blanks, field blanks, and trip blanks will be sent to the chemical laboratory for analysis. Quality control is discussed in greater detail in Sections 4 and 10.

11.2.2 Laboratory Accuracy

Procedures to evaluate laboratory accuracy are described in the laboratory QAPP and SOPs. Measurements of accuracy will be used in determining if the laboratory is in control.

Chemical laboratory data accuracy will be assessed through the calculation of % Recovery from MS/MSD analysis and any certified standards that the laboratory analyzes as part of its ongoing QA/QC program. Percent Recovery is calculated as

$$\% \text{ Recovery} = \frac{\text{SSR} - \text{SR}}{\text{SA}} \times 100\%$$

where

SSR = spiked sample result

SR = sample result

SA = spike added.

Sample blanks will be run by the laboratory to quantify contamination.

11.4 Representativeness

Representativeness is the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is closely connected to proper design of the sampling program. The representativeness criterion is best satisfied by proper sampling location selection and collection of sufficient samples. UST excavation sample collection will be biased to areas of highest detectable or potential contamination.

11.5 Comparability

All data will be reported in units consistent with the conventions used for the given analyte and methods employed. The analytical results can be compared with analyses by other laboratories because of the use of

- Standard methodology
- Analytical results from similar matrices in consistent units
- Application of appropriate levels of quality control within the context of the Laboratory Quality Assurance Program.

11.6 Overall Precision and Completeness

The best estimate of the overall precision is the standard deviation or % RSD calculated from the field duplicates or replicates, as discussed in Section 11.1.1. The field precision calculated from the replicates actually does contain a component of variation due to the laboratory. However, the laboratory variability is expected to be small compared to the field variation.

The completeness of the data is the amount of valid data obtained from the measurement system or laboratory analysis versus the amount of data planned to be collected from the field. The specific objective for completeness of this project is 90%.

12. DATA MANAGEMENT

Data management is being addressed by the ERP data management staff. Portions of the DMS are in different stages of development. The DMS is being developed using guidance of standard data management practices to ensure the overall integrity of the data it captures.

The DMS is designed cognizant of the need to capture large volumes of data from several ERP programs. The DMS also is designed around the requirements that it ensure reliable, consistent, and effective flow, treatment, storage, and retrieval of all data. The DMS captures SAP data, field sampling data, and analytical data. Additional data types will be incorporated into the DMS as the needs arise.

Portions of the DMS are currently under development. However, the portion that captures SAP, field, and analytical data for chemical analysis samples is in place and functional. The flow process for these data is depicted in Figure 9-1. The data are channeled through the ARDC to ensure that a consistent flow path is maintained.

The DMS will include software for database management, data analysis, and report generation. The DMS contains a well-defined set of files with standardized record structures for maintaining the data and for archival purposes. This uniformity of data storage makes possible the integration of data from different ERP programs and maintenance of a global DMS for all ERP data.

Data entry, retrieval, manipulation, and report production capabilities either exist or will be developed for all data sets. The DMS will include several levels of automated verification and validation to ensure the highest level of reliability, accuracy, and quality in the data captured by the system.

13. SAFETY AND TRAINING

The Health and Safety Plan establishes the procedures and provides general guidelines for worker and public safety to be used by EG&G Idaho, Inc. and subcontractors during characterization of the project area (EG&G, 1990).

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