SAMPLING AND ANALYSIS PLAN
FIELD SAMPLING PLAN - PART B

Wenatchee Tree Fruit Research Center (TFREC) Test Plot Remediation
Wenatchee, Washington

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1. INTRODUCTION

1.1 SITE HISTORY AND CONTAMINATION

The test plot area (test plot) at the Wenatchee Tree Fruit Research Center **(**TFREC) was initially used by the U.S. Public Health Service (PHS), and later by the U.S. Environmental Protection Agency (EPA), as a test facility to determine the effectiveness of various land disposal methods for pesticides. Testing began in 1966 and continued until the early 1980s. Research focused on disposal of organochlorine (OC) and organophosphorus (OP) pesticides, but could possibly have included testing of other pesticides.

In the mid-1980s the property was transferred from the EPA to Washington State University (WSU). Additional test and laboratory facilities are operated by WSU at TFREC. Due to its concern about pesticide contamination, WSU performed limited sampling and analysis of soil in and near the test plot. WSU contacted EPA and asked for assistance in characterizing and remediating the contamination problem.

EPA and its contractors performed site investigations, as well as sampling and analysis, in 1990, 1991, and 1994. EPA's Office of Research and Development (ORD) has obtained the assistance of the Seattle District U.S. Army Corps of Engineers (USACE) and has tasked the USACE to remediate the test plot, as well as characterize contamination in the drain field area (drain field) of the site.

1.2 SUMMARY OF EXISTING SITE DATA

1.2.1 EPA Experiments

A review of six (6) journal articles published by EPA researchers in the 1970s was performed. Additionally, several of the researchers were contacted and interviewed for more information regarding the experiments. It was determined that three methods of pesticide disposal were used.

The first involved placing a 12"x12" metal frame on the ground, digging out the soil to a depth of 2" within the frame, mixing the pesticide with soil (and sometimes acetone and zinc metal) and placing the soil/pesticide mixture back into the excavation. The second was a variation on the first, with a concrete block with two hollow chambers (standard concrete block) placed in a 2" excavation, and with the soil/pesticide mixture placed in the concrete block's chambers. The third method involved placing pure pesticide (DDT and parathion), mixed with lime, lye, or Purax, in a bag and burying at a depth of 2'-3'. The bags were marked by driving a metal spike through the bag and backfilling the hole with soil, with the spike protruding from the ground.

The research articles indicated that, in general, the pesticide contamination did not migrate down into the soil beyond 8" from the initial location at appreciable concentrations. Migration in other directions was assumed to be negligible. The EPA data, collected as much as eight years after initial disposal, demonstrate that their downward migration finding is correct. Thus, it is assumed that contamination of significant concentrations will not be found more than one foot below the initial disposal location, and removal of contaminated soil should be limited to the top foot in the shallow burial locations, and to less than four feet in depth (possibly confined to a layer between 2' and 4') in the deep burial locations. Although the EPA researchers did not collect data to back up their hypothesis regarding migration in other directions, general knowledge about the transport of pesticides in soil agrees with their negligible migration assumption.

A sketch of the test plot was drawn by the researchers in the 1970s and was supplied by EPA to the USACE. The sketch indicates the pesticide disposed in each test plot row, as well as the rows with deep burial. This sketch's accuracy has not been verified, although some physical markers (spikes in deep burial rows) still exist. Sampling and analysis performed by WSU, EPA, and the USACE have yielded results that contradict the sketch. Contaminants that are not indicated as being disposed in a particular plot sometimes have higher soil concentrations than the contaminant that the sketch indicates has been buried in that plot.

GSA will assume that the deep burial locations can be verified by the spikes remaining in the test plot rows. GSA will not exclusively use the Test Plot sketch, provided to the USACE by EPA, to determine the contaminants of concern in each test plot row.

1.2.2 WSU and EPA Site Investigations (After EPA Experiments)

Sampling and analysis of soil both in and near the test plot, as well as background samples, were performed by both WSU and the EPA. The locations and results of the sampling efforts can be found in Table 1. From these results, the USACE concluded that the horizontal extent of contamination is likely confined to the fenced test plot, and additionally to another three feet beyond the northern edge of the test plot, as well as an additional 5.5' beyond the eastern edge of the test plot. In order to obtain data to define the extent of contamination, as defined by MTCA Method B levels, the USACE has extended the area of potential contamination ten feet beyond the western edge of the test plot. Data indicate that the southern edge of the test plot marks the southern extent of contamination from the test plot.

Non-orchard area background data taken by EPA indicate that the background pesticide levels do not exceed the Washington State Model Toxics Control Act (MTCA) Method B cleanup levels. EPA and Washington State Department of Ecology (Ecology) determined that the USACE' list of contaminants of concern, found in Table 2, are acceptable for the site.

Samples taken from the test plot area showed locations where organochlorine pesticides are a potential contamination concern, and where organophosphorus pesticides are a potential contamination concern. Additionally, locations within and near the test plot with minimal to no data regarding contamination were identified. Based on these analysis results and review of site data, it was determined that field screening and fixed laboratory analyses during the characterization of remediation area could be focused to analyze for the contaminants of concern. Samples from columns 2, 3, 4, 5, 6, 7, and 8 will be analyzed in the fixed laboratory for both organophosphorus and organochlorine pesticides during the characterization phase of the project. Columns 1 and 9 will only be analyzed for organochlorine pesticides during the characterization phase.

The site characterization results from WSU and EPA indicate that MTCA Method B is an appropriate method for setting the cleanup levels for the contaminants of concern for which MTCA Method B levels have been calculated. For COCs that do not have calculated MTCA Method B levels, EPA, Ecology, and WSU agreed to use the MTCA Method B cleanup levels for their parent compounds (e.g. endrin ketone and endrin aldehyde will have the action level of endrin, endosulfan sulfate will have the action level of endosulfan I). EPA, Ecology, and WSU also agreed that the soil concentrations of the isomers of DDT shall be added up and compared with the DDT action level for the site. The same procedure shall be performed for the DDE isomers and the DDD isomers. EPA, Ecology, and WSU have all agreed that these are appropriate cleanup levels for the Test Plot.

Waste characterization will address both the federal Toxicity Characteristic (reference) and the State of Washington Dangerous Waste categories for toxic and persistent wastes that are dependent on the concentrations of multiple toxic constituents (WAC 173-303-100).

Table 1
Historical Site Sampling Results

Sample Location	COC Label	Depth (inches bgs)	Collected By	Date	Contaminants	mg/kg (bold above MTCA B)	QA Flags (J, U, DJ, or UJ)	Notes
Parathion (deep) Grid #2	T404301	Surface	E&E	1994	DDE	2.30E+00		No OP pesticide analysis
					DDD	4.10E-02	J	
					DDT	1.80E+00		
Dieldrin & Endrin Grid #3	T404302	0-2	E&E	1994	Dieldrin	**9.60E+00**	J	All detection levels raised above MTCA B, No OP analysis
					Endrin Ketone	2.20E+02		
DDT/Zn Grid #4	T404303		E&E	1994	Dieldrin	**1.70E-01**	J	No OP analysis
					Endrin Ketone	3.90E-01		
					DDE	2.00E+00		
					DDT	1.50E+00		
MPAR/Zn Grid #5 (duplicate 1)	T404304		E&E	1994	Dieldrin	**3.90E-01**	J	No OP analysis
					Endrin Ketone	2.10E-01		
					DDE	**5.40E+00**		
					DDT	**3.60E+00**		
MPAR/Zn Grid #5 (duplicate 2)	T404305		E&E	1994	Dieldrin	**2.50E-01**	J	No OP analysis
					Endrin Ketone	1.30E-01		
					DDE	**4.00E+00**		
					DDT	**3.20E+00**		
Methyl Parathion Grid #6	T404306		E&E	1994	Dimethoate	4.90E-01		OP and OC analysis
					Di-Sulfoton	**5.70E+02**		
					Endosulfan I	7.90E-02	J	
					Endosulfan II	8.10E-01	J	
					Endosulfan Sulfate	7.10E-01		
					Endrin	3.70E-01	J	
					Endrin Aldehyde	2.20E-01		
					DDE	2.10E+00		
					DDT	1.20E+00		
Parathion Grid #7	T404307		E&E	1994	Di-Sulfoton	5.30E-01		OP and OC
					Endosulfan Sulfate	7.90E-02	J	
					DDE	**3.10E+00**		
					DDT	2.10E+00		
Parathion Grid #8	T404308		E&E	1994	Di-Sulfoton	3.30E-01		OP and OC
					DDE	**3.90E+00**		Very close to MTCA B
					DDT	2.90E+00		

Table 1 (Continued)
Historical Site Sampling Results

Sample Location	COC Label	Depth (inches bgs)	Collected By	Date	Contaminants	mg/kg (bold above MTCA B)	QA Flags (J, U, DJ, or UJ)	Notes
Core near Grids	BH1	0-2"	E&E	1994	DDE (0")	**5.60E+00**		Location uncertain
#4 & 5	T404309 (0-2")				DDT (0")	**4.70E+00**		
	T404210 (12")	12"			DDE (12")	6.80E-01		
					DDT (12")	5.10E-02	J	
	T404311 (24")	24"			DDE (24")	1.20E+00		
					DDT (24")	**4.40E+00**		
Core in Grid #3	BH2		E&E	1994	Dieldrin (0")	**1.10E+00**		Location uncertain
	T404312 (0-2")	0-2"			Endrin (0")	3.20E-01	J	
					Endrin Ketone (0")	6.90E+00		
					Endrin Aldehyde (0")	ND	U	
					DDE (0")	1.10E+00		
					DDT (0")	4.60E-01	J	
	T404313 (12")	12"			Dieldrin (12")	4.30E-01	J	
					Endrin (12")	1.70E+00	J	
					Endrin Ketone (12")	3.10E+00		
					Endrin Aldehyde	3.90E-01	J	
					DDE (12")	9.60E-01		
					DDT (12")	3.90E-01	J	
	T404314 (24")	24"			Dieldrin (24")	3.10E-03	J	
					Endrin (24")	ND	U	
					Endrin Ketone (24")	ND	U	
					Endrin Aldehyde	ND	U	
					DDE (24")	ND	U	
					DDT (24")	1.80E-02	J	
Grid #7	TP-1		PRC	1991	DDE	**3.20E+00**	DJ	OC, OP, and Carbamate
					DDT	**3.40E+00**	DJ	
					Endrin	**6.50E-02**	J	
Grid #9	TP-2		PRC	1991	DDE	**4.70E+00**	J	OC, OP, and Carbamate
close to O-3 samples					DDT	1.10E+01	J	
Grid #9	TP-3		PRC	1991	DDE	**5.10E+00**	J	OC, OP, and Carbamate
Same as TP-2					DDT	**9.80E+00**	J	
Grid #9	TP-4		PRC	1991	DDE	**3.10E+00**	J	OC, OP, and Carbamate
close to O-1					DDT	**3.40E+00**	J	

Table 1 (Continued)
Historical Site Sampling Results

Sample Location	COC Label	Depth (inches bgs)	Collected By	Date	Contaminants	mg/kg (bold above MTCA B)	QA Flags (J, U, DJ, or UJ)	Notes
South of Grid #6	TP-5		PRC	1991	DDE	5.60E-01	J	OC, OP, and Carbamate
					DDT	4.30E-01	J	
South of Grid #4	TP-6		PRC	1991	Dieldrin	1.20E-03	J	OC, OP, and Carbamate
					DDE	1.10E-02	J	
					DDT	1.10E-02	J	
Grid #1	TP-7		PRC	1991	DDE	1.30E+00	J	OC, OP, and Carbamate
					DDT	6.10E-01	J	
South of Grid #8 about 18 feet south	TP-8		PRC	1991	DDE	1.20E+00	J	OC, OP, and Carbamate
					DDT	1.10E+00	J	
South of Grid #9 about 50 feet south	TP-9		PRC	1991	DDE	4.10E-01	J	OC, OP, and Carbamate
					DDT	2.90E-01	J	
South of Grid #9 about 18 feet south	TP-10		PRC	1991	DDE	8.70E-01	J	Duplicate with TP-11
					DDT	7.10E-01	J	OC, OP, and Carbamate
Same as TP-10	TP-11		PRC	1991	DDE	1.00E+00	J	Duplicate with TP-10
					DDT	8.70E-01	J	OC, OP, and Carbamate
Non-Orchard 0.5 miles west of test	NO-1		PRC	1991	DDE	**3.40E+00**	J	OC, OP, and Carbamate
					Endosulfan Sulfate	1.70E-02	J	
					DDT	2.60E+00	J	
Non-Orchard 0.5 miles west of test	NO-2		PRC	1991	DDE	4.20E-02	J	OC, OP, and Carbamate
					DDT	3.10E-02	J	
Non-Orchard 0.5 miles west of test	NO-3		PRC	1991	various pesticides	below detection		Duplicate with NO-4 OC, OP, and Carbamate
Non-Orchard 0.5 miles west of test	NO-4		PRC	1991	various pesticides	below detection		Duplicate with NO-3 OC, OP, and Carbamate
Grid #8	#I-1	no depth info	WSU	1987	Ethyl Parathion	2.00E-01		Composite samples
					Ethyl Paraoxon	NAR		
					Dieldrin	1.40E-02		
					DDE	1.40E+00		
					PP-DDT	2.60E+00		
					OP-DDT	8.00E-01		
Grid #9	#O-1	no depth info	WSU	1987	Ethyl Parathion	2.00E-01		Composite samples
					Ethyl Paraoxon	NAR		
					Dieldrin	NAR		

Table 1 (Continued)
Historical Site Sampling Results

Sample Location	COC Label	Depth (inches bgs)	Collected By	Date	Contaminants	mg/kg (bold above MTCA B)	QA Flags (J, U, DJ, or UJ)	Notes
					DDE	2.00E+00		
					PP-DDT	3.50E+00		
					OP-DDT	1.10E+00		
Grid #8	#I-2	no depth info	WSU	1987	Ethyl Parathion	1.40E-01		Composite samples
					Ethyl Paraoxon	NAR		
					Dieldrin	NAR		
					DDE	1.30E+00		
					PP-DDT	**2.00E+00**		
					OP-DDT	6.00E-01		
Grid #9	#O-2	no depth info	WSU	1987	Ethyl Parathion	2.00E-01		Composite samples
					Ethyl Paraoxon	NAR		
					Dieldrin	2.00E-02		
					DDE	1.70E+00		
					PP-DDT	1.90E+00		
					OP-DDT	6.00E-01		
Grid #8	#I-3	no depth info	WSU	1987	Ethyl Parathion	2.00E-01		Composite samples
					Ethyl Paraoxon	NAR		
					Dieldrin	1.60E-02		
					DDE	2.30E+00		
					PP-DDT	**4.80E+00**		
					OP-DDT	9.00E-01		
Grid #9	#O-3	no depth info	WSU	1987	Ethyl Parathion	2.00E-01		Composite samples
					Ethyl Paraoxon	NAR		
					Dieldrin	NAR		
					DDE	2.30E+00		
					PP-DDT	**4.10E+00**		
					OP-DDT	1.30E+00		
Grid #8	#I-1	no depth info	WSU	1986	Ethyl Parathion	1.00E-01		Composite samples
					Ethyl Paraoxon	NAR		
					Dieldrin	NAR		
					DDE	7.00E-01		
					PP-DDT	1.00E+00		
					OP-DDT	3.00E-01		

Table 1 (Continued)
Historical Site Sampling Results

Sample Location	COC Label	Depth (inches bgs)	Collected By	Date	Contaminants	mg/kg (bold above MTCA B)	QA Flags (J, U, DJ, or UJ)	Notes
Grid #9	#O-1	no depth info	WSU	1986	Ethyl Parathion	NAR		Composite samples
					Ethyl Paraoxon	NAR		
					Dieldrin	NAR		
					DDE	3.00E-01		
					PP-DDT	6.00E-01		
					OP-DDT	2.00E-01		
Grid #8	#I-2	no depth info	WSU	1986	Ethyl Parathion	NAR		Composite samples
					Ethyl Paraoxon	NAR		
					Dieldrin	NAR		
					DDE	9.00E-01		
					PP-DDT	1.20E+00		
					OP-DDT	4.00E-01		
Grid #9	#O-2	no depth info	WSU	1986	Ethyl Parathion	NAR		Composite samples
					Ethyl Paraoxon	NAR		
					Dieldrin	NAR		
					DDE	4.00E-01		
					PP-DDT	7.00E-01		
					OP-DDT	2.00E-01		
Grid #8	#I-3	no depth info	WSU	1986	Ethyl Parathion	1.00E-01		Composite samples
					Ethyl Paraoxon	NAR		
					Dieldrin	NAR		
					DDE	1.20E+00		
					PP-DDT	1.60E+00		
					OP-DDT	1.40E-01		
Grid #9	#O-3	no depth info	WSU	1986	Ethyl Parathion	5.30E-02		Composite samples
					Ethyl Paraoxon	NAR		
					Dieldrin	NAR		
					DDE	3.00E-01		
					PP-DDT	5.00E-01		
					OP-DDT	5.00E-01		
Grid #2	85-#1	0-6"	WSU	1985	Ethyl Parathion	2.00E-01		Two sample composite
					Ethyl Paraoxon	trace		
					Dieldrin	NAR		

Table 1 (Continued)
Historical Site Sampling Results

Sample Location	COC Label	Depth (inches bgs)	Collected By	Date	Contaminants	mg/kg (bold above MTCA B)	QA Flags (J, U, DJ, or UJ)	Notes
					DDE	**4.01E+02**		
					PP-DDT	1.60E+00		
					OP-DDT	5.00E-01		
Grid #4	85-#2	0-6"	WSU	1985	Ethyl Parathion	0.00E+00		
					Ethyl Paraoxon	1.46E+03		**No MTCA levels, but very toxic**
					Dieldrin	NAR		
					DDE	**8.16E+02**		
					PP-DDT	**3.08E+03**		
					OP-DDT	**1.26E+02**		

NAR - No Analysis Requested; ND - None Detected.

1.3 SITE SPECIFIC SAMPLING AND ANALYSIS PROBLEMS

The immunoassay analysis (IAA) exhibits some cross sensitivity for various compounds that might be present simultaneously. Therefore, a primary objective will be to correlate the IAA results with definitive fixed laboratory results prior to making decisions regarding depth of remedial excavation. All samples taken in the sampling grid will be homogenized and split into three sub samples, allowing for the archival of some samples and additional analysis if necessary.

Table 2 contains the regulatory limits for some of the compounds of interest. The action limits for additional compounds will be those of the related parent compound. In the case of DDT isomers, the limit for DDT listed in Table 2 will be applied to the sum of the individual isomers.

2. PROJECT ORGANIZATION AND RESPONSIBILITIES

Refer to the Statement of Chemical Qualifications for organizational structure and individual responsibility for sampling and data quality.

3. SCOPE AND OBJECTIVES

The project objectives are as follows:

1. Evaluation of the extent of contamination in soil by the pesticides of concern (POC), removal and segregation of soil, and confirmation sampling to verify the completion of removal activities. All pesticides previously identified as being parent or breakdown pesticides potentially associated with the test plot area were included as POCs for this removal action. The cleanup standards for the site are shown in Table 2 as well as the MTCA Method B criteria. The following compounds are expected to be encountered during this project:
    - Organochlorine pesticides. This includes para-para and ortho-para isomers of DDT, DDD, and DDE and breakdown products of many of the compounds of interest.
    - Organophosphorus pesticides.
    - Carbamate pesticides and paraquat.
2. Demonstration that the categorization of wastes generated during this contract is adequate for compliance in labeling, transporting, treatment (if appropriate) and disposal. This demonstration requires full documentation of completion of off-site activities that reduce the toxicity to levels acceptable for final disposal in accordance with all applicable environmental laws and statutes. Analytes of interest include metals.
3. Monitoring of workers and the environment as needed to assure acceptably low levels of exposure during remediation.

The subsections below describe the following sampling tasks:

- Confirmation sampling in the focused removal trenches.
- Waste characterization.
- Characterization of test plot area.
- Final confirmation.
- Decontamination rinse water characterization.

Table 2
Project Cleanup Standards and Regulatory Criteria

Contaminant or Suspected Contaminant	MTCA Method B (mg/kg)	EPA Region III Residential (mg/kg)	EPA Region IX Residential (mg/kg)	EPA Region III Industrial (mg/kg)	EPA Region IX Industrial (mg/kg)	WA DW Designation (TCLP mg/L)	WA DW Designation est. (mg/kg)	WAC Toxic Category**	Universal Treatment Std. (mg/kg,, unless TCLP)
ORGANOCHLORINE PESTICIDES									
dieldrin	6.25E-02	4.00E-02	2.8E-02	3.60E-01	1.2E-01	none	none	B (38.3)	1.30E-01
endrin	2.40E+01	2.30E+01	2.0E+01	6.10E+02	2.0E+02	2.00E-02	4.00E-01	A (3)	1.30E-01
endrin aldehyde*	2.40E+01	none	none	none	none	none	none	-	1.30E-01
endrin ketone*	2.40E+01	none	none	none	none	none	none	B (10)	none
endosulfan I	4.80E+02	4.70E+02	3.3E+00	1.20E+04	3.4E+01	none	none	C (76)	6.60E-02
endosulfan II	4.80E+02	4.70E+02	3.3E+00	1.20E+04	3.4E+01	none	none	C(240)	1.30E-01
endosulfan sulfate*	4.80E+02	none	none	none	none	none	none	B (18)	1.30E-01
DDT	2.94E+00	1.90E+00	1.3E+00	1.70E+01	5.6E+00	none	none	C (87)	8.70E-02
DDE	2.94E+00	1.90E+00	1.3E+00	1.70E+01	5.6E+00	none	none	D (800)	8.70E-02
DDD	4.17E+00	2.70E+00	1.9E+00	2.40E+01	7.9E+00	none	none	C (113)	8.70E-02
gamma-BHC (lindane)	7.69E-01	none	none	none	none	4.00E-01	8.00E+00	C (76)	6.60E-02
ORGANOPHOSPHORUS PESTICIDES									
Di-Syston (disulfoton)	3.20E+00	3.10E+00	2.6E+00	8.20E+01	2.7E+01	none	none	A (2.6)	none
guthion (azinphosmethyl)*	3.20E+00	none	none	none	none	none	none	B (7)	6.20E+00
parathion	4.80E+02	4.70E+02	3.9E+02	1.20E+04	4.1E+03	none	none	A (2)	4.60E+00
methyl parathion	2.00E+01	2.00E+01	1.6E+01	5.10E+02	1.7E+02	none	none	B (6.01)	4.60E+00
aminomethyl parathion*	2.00E+01	none	none	none	none	none	none	-	none
malathion	1.60E+03	1.60E+03	1.3E+03	4.10E+04	1.4E+04	none	none	C (290)	none
ethion	4.00E+01	3.90E+01	3.3E+01	1.00E+03	3.4E+02	none	none	B (13)	none
DDVP (dichlorvos)	3.44E+00	2.20E+00	1.5E+00	2.00E+01	6.6E+00	none	none	B (17)	none
diazinon	7.20E+01	7.00E+01	5.9E+01	1.80E+03	6.1E+02	none	none	B (17)	none
dimethoate	1.60E+01	none	none	none	none	none	none	C (60)	none
paraoxon-ethyl*	4.80E+02	none	none	none	none	none	none	A (1.8)	none
paroxon-methyl*	2.00E+01	none	none	none	none	none	none	A (3.27)	none
CARBAMATE PESTICIDES									
carbaryl	8.00E+03	7.80E+03	6.5E+03	2.00E+05	6.8E+04	none	none	C (230)	none
furadan (carbofuran)	4.00E+02	3.90E+02	3.3E+02	1.00E+04	3.4E+03	none	none	B (5.0)	none
MISC. PESTICIDES									
paraquat	3.60E+02	3.50E+02	2.9E+02	9.20E+03	3.1E+03	none	none	C (100)	none

* - Indicates the action level is based on the parent compound's action level ** - Rat oral LD 50 in mg/kg (source: RTECS)
WA DW = Dangerous Waste (Washington State WAC 173-303) EHW = Extremely Hazardous Waste (Washington State WAC 173-303) WA DW Designation estimate = TCLP limit X 20

4. FIELD ACTIVITIES

4.1 SOIL CONFIRMATION SAMPLING IN THE FOCUSED REMOVAL TRENCHES

The two deep burial trench locations will be excavated in three lifts to allow for segregation of the surface soils from the anticipated more highly contaminated soils in contact with the bags of pesticide. At the completion of this phase there will be:

1. One trench for the OC pesticide area, excavated to a depth of six inches below the depth of the bags.
2. One trench for the OP pesticide area, excavated to a depth of six inches below the depth of the bags.

The two deep burial trenches will possibly create six soil contamination groups. The first two are the deep lifts around the bags in the two trenches (designated as discarded commercial waste). The other four lifts will be given preliminary designation (along with the soils to be removed and segregated during gross removal) once the site characterization push-sample results are evaluated and correlated.

4.1.1 Sample Collection Frequency And Rationale

A minimum total of six surface samples will be taken from the bottom of the two focused removal trenches (see Table 3). Further excavation may be required if analysis (either immunoassay or fixed-lab) shows levels above the Method B cleanup standards in Table 2. Sampling placement will be influenced by the location of the bags that were removed. Up to 20 samples may be taken in this confirmation/characterization effort. Samples above the minimum of 6 will need to be coordinated with the Corps QA representative. Refer to the QAPP for details regarding Performance Evaluation samples.

Table 3
Focused Removal Sampling Schedule

Analyte	Location	Samples	Type	Frequency	Total No. Samples
1. IAA 2. OP and OC Pesticide	Bottom of focused removal trenches	Minimum 3 per trench	Discrete surface sample, homogenized	2 trenches	6*

* Up to 20 samples may be taken in this confirmation/characterization effort.

4.1.1.1 Sample Locations

The sample locations will be biased to be the most highly contaminated areas in the trenches.

4.1.1.2 Discrete/Composite Sampling Requirements

The samples will be discrete surface samples, homogenized thoroughly as described in the sampling procedures and split into three sub-samples.

4.1.1.3 Sample Collection and Field and Laboratory Analysis

The samples will be collected with a spade, polyethylene scoop, or stainless steel auger. One of the split samples will be analyzed by IAA in the field laboratory and the other sent to the fixed laboratory for OP/OC analysis. The third sample will be reserved for QC analysis.

4.1.1.4 QA, QC, and Blank Sample Frequency

QC samples will be collected at a rate of 10% of the primary samples as per Table 4. QA split samples will not be collected.

Table 4
Focused Removal Field QA/QC Frequency

Analyte	Location	No. of Samples	Frequency of Rinsate Blanks	Trip Blanks	10% Field QC Samples (Blind duplicate)	Archived Sample Jars
1. IAA 2. OP and OC Pesticide	Focused removal trenches	6 (2 trenches)	1	NA	10%, Minimum of 1	6
OP and OC Pesticide	Performance Evaluation (PE) Sample	Minimum of 2	NA	NA	In first week of laboratory analysis, 4 throughout project	NA

4.1.2 Procedures

4.1.2.1 Sampling Methods

The following steps will be used to ensure representative samples and thorough homogenization:

1. The first inch or two will be brushed aside with the sampling device.
2. Samples will be taken with a decontaminated stainless steel spoon, polyethylene scoop (for example, VWR 56924-503) or a decontaminated hand auger.
3. Soil will be collected into a dedicated 1/2 gallon glass jar (precleaned as per EPA specifications) for initial debris removal (stones and sticks > 3/8"), crushing , and mixing. Mixing, crushing, and shaking will be applied as needed to get a visually homogeneous mixture of the soil. The preference is to use a mechanical tumbler so that less labor is needed to get a well mixed sample.
4. If conditions require an alternative, a decontaminated spade and a stainless steel spoon will be used to sample. Also, Ziplock bags may serve as the initial mixing/separating container (kneading with a roller may then be necessary).
5. Final homogenization will be by coning and quartering as follows:
   a) The soil will be drawn up into a cone followed by splitting into four separate cones.
   b) Each small cone will be stirred with a stainless steel spoon to an even consistency.
   c) Two neighboring small cones will be joined after mixing of the individual quarters and mixed and drawn together. The other two small cones are likewise mixed together.
   d) Finally the two separate mixtures are joined and mixed.
6. Care will be taken to keep the samples from being exposed to direct sunlight. Jars will be wrapped in foil and/or placed in coolers when not being worked on.

Samples will be split into three sampling jars precleaned to EPA specifications.

4.1.2.2 Field Measurement Procedures and Criteria

The IAA analysis and criteria for correlation with fixed-laboratory analysis is covered in detail in the QAPP and requires a ten gram sample that is extracted with methanol.

4.1.2.3 Sample Containers and Preservation Techniques

Sample containers will be obtained from the analytical laboratory as indicated on Table 5.

Table 5
Focused Removal Sampling Container, Preservation, and Holding Time Criteria

Analyte	Method	Sample Type	Preser-vation	Holding Time	Turn-around Time	Type	No. per Sample	Total No. Jars Project+QC+ Archived
OP and OC Pesticides	EPA 8081 and 8140	Soil	4°C	14 days to extraction/ 40 days until analysis	72 hrs	8 oz wide mouth	1*	6** +1 +6*
OP and OC Pesticides	EPA 8081 and 8140	Water	4°C	7 days to extraction/ 40 days until analysis	72 hrs	1 L amber, teflon cap	2*	1* +0 +0
IAA	EPA 4041 and 4042	Soil	4°C	14 days to extraction	24 hrs.	4 oz wide mouth	1*	6 +1 +0

* Additional jars are not needed for MS/MSD (for water, a laboratory control sample will suffice). Any samples beyond the initial six will be coordinated with the Corps QAR.

** Samples for MS/MSD should be selected on the COC or analysis request form.

4.1.2.4 Field Quality Control Sampling Procedures

QC duplicates will be collected at a 10% rate (no QA split samples will be taken). Each sample will be homogenized and split into three replicates and a fourth when the QC sample is taken (an additional split will be created as directed by the Washington DOE representative). One rinsate blank will be taken for this confirmation sampling effort. Reagent grade water will be poured over the decontaminated sampling device and sampling spoon.

4.1.2.5 Decontamination Procedures

Cross contamination during sample collection will be minimized by the use of disposable gloves which will be replaced for every sample collected. Any non-disposable equipment will be cleaned thoroughly with non-phosphate laboratory detergent, distilled water, and triple rinsed with analyte-free water followed by reagent-grade methanol. Upon completion of sampling, all non-reusable sampling equipment, including gloves, will be disposed of properly. Refer to Section 4.2.2.5 for disposal procedures for decontamination water.

4.2 SITE SOIL CHARACTERIZATION

The gross removal excavation of the test plot soil will be directed by the analytical results from the characterization phase.

4.2.1 Sample Collection Frequency and Rationale

During the characterization phase, 27 grid locations will be cored to a depth of 6 feet to create 162 samples, one sample from each one-foot lift, as indicated in Table 6. The spacing of the grid was previously determined on a statistical basis to be able to detect a hypothetical 5' by 10' elliptical hot spot. Each location will be cored twice to ensure that enough soil will be collected to provide for the homogenized three-way split. The two one-foot core segments for each lift will be homogenized prior to splitting into three equivalent subsamples.

The analytical work will be divided into two segments. The first will be analysis of samples in the columns that do not contain test plot rows with deep burials (called "shallow burial"). According to field observations, columns 1, 6, 7, 8, and 9 do not have deep burials. The second work segment will be analysis of samples in columns that do contain test plot rows with deep burials. Recent site reconnaissance has determined that the historical data does not agree with the physical markers (metal spikes, concrete blocks, metal frames) remaining in the test plot area. Metal spikes, indicators of deep burial, have been observed in columns 2, 3, 4, and 5. Rows with observed metal frames and concrete blocks do not match the locations given in historic records. Additionally, soil pots with metal screen material are disposed in locations where historical information does not indicate any experiments were conducted.

Field observations will be used to determine which columns appear to have deep burials and which columns appear to have shallow burials. Although samples will be taken at each lift for all grids, not all samples will be analyzed. The following scheme will be used.

4.2.1.1 Shallow Burial Column Sample Field Screening Analysis

GSA will analyze the 0-12" soil samples from each of the shallow-only burial columns indicated on the sampling grid map. Analyses will be performed using the field kits.

If the 0-12" sample yields results that show the initial field kit action levels have not been exceeded, GSA will determine which grid at 0-12", for each column, yields immunoassay kit results closest to the kit action levels. A sample from the most contaminated 0-12" grid from each column shall be sent to the fixed laboratory for definitive analysis. Grids from columns 1 and 9 shall be analyzed for OC pesticides alone. All other grids shall be analyzed for both OC and OP pesticides.

If the 0-12" field sample yields results for either field kit at or above its initial action level, GSA will field analyze the 12-24" sample in the same manner as the 0-12" field sample. GSA will use the sample analysis decision matrix for the Shallow Burial Columns, found in Table 7. Once the apparent extent of contamination has been determined using the field analysis, GSA will send a pair of samples from each grid to the fixed laboratory and re-calibrate the field test kit action levels, as described in Section 4.2.1.3.

Table 6
Soil Characterization Sampling Schedule

Analyte	Location	Samples per Event	Type	Frequency	Total Number of Primary Samples
IAA - shallow burial columns (1, 6, 7, 8, and 9)	15 grid locations, focused positions or random as needed.	6 lifts per grid	12" core sections, 2 cores per location, homogenized	15 grids. Analyze from top down to first lift below IAA action limits (cyclodiene 100 ppb, DDT 5 ppm)	90 (analyze est. 45 - 90)
IAA - deep burial columns (2,3,4,5)	12 grid locations, focused positions or random as needed.	6 lifts per grid	12" core sections, 2 cores per location, homogenized	12 grids. Analyze first 3 lifts from top and down to first lift below IAA action limits (cyclodiene 100 ppb, DDT 5 ppm)	72 (analyze est. 36 -72)
OC Pesticide-only columns 1 and 9	2 columns, 6 grid locations, focused positions or random as needed	6 lifts per grid	12" core sections, 2 cores per location, homogenized	6 grids. Round 1: Analyze a sample from the two lifts bracketing the limit within the "hottest" grid in each column Round 2: Analyze a sample from the lift just below adjusted action limit from other two grids in each column	36 (Round 1, analyze 4) (Round 2, analyze 4)
OP and OC Pesticide	7 columns, 21 grid locations, focused positions or random as needed	6 lifts per grid	12" core sections, 2 cores per location, homogenized	21 grids. Round 1: Analyze a sample from the two lifts bracketing the limit within the "hottest" grid in each column Round 2: Analyze a sample from the lift just below adjusted action limit from other two grids in each column	126 (Round 1, analyze 14) (Round 2, analyze 14)

Table 7
Decision Matrix for the Shallow Burial Columns

Scenario #	0 to 12”	12 to 24”	24 to 36”	36 to 48”	48 to 60”	60 to 72”	Action
1	No	n/a	n/a	n/a	n/a	n/a	Confirmation Sampling
2	Yes	No	n/a	n/a	n/a	n/a	Find contamination in 0-12” sample, field sample 12-24” sample. Find no contamination in 12-24” sample above MTCA: Remove 0-12” of soil. Confirmation Sampling. No Further Action.
3	Yes	Yes	No	n/a	n/a	n/a	Find contamination in 0-12” sample, field sample 12-24” sample. Find contamination in 12-24” sample, field sample 24-36” soil sample. Find no contamination in 24-36” sample above MTCA: Remove 0-24” of soil. Confirmation Sampling. No Further Action.
4	Yes	Yes	Yes	No	n/a	n/a	Find contamination in 0-12” sample, field sample 12-24” sample. Find contamination in 12-24” sample, field sample 24-36” soil sample. Find contamination in 24-36”sample, field sample 36-48” soil sample. Find no contamination in 36-48” sample above MTCA: Remove 0-36” of soil. Confirmation Sampling. No Further Action.
5	Yes	Yes	Yes	Yes	No	n/a	Find contamination in 0-12” sample, field sample 12-24” sample. Find contamination in 12-24” sample, field sample 24-36” soil sample. Find contamination in 24-36” sample, field sample 36-48” soil sample. Find contamination in 36-48” above MTCA, field sample 48-60” soil sample. Find no contamination in 48-60” sample above MTCA: Remove 0-48” of soil. Confirmation Sampling. No Further Action.
6	Yes	Yes	Yes	Yes	Yes	No	Find contamination in 0-12” sample, field sample 12-24” sample. Find contamination in 12-24” sample, field sample 24-36” soil sample. Find contamination in 24-36” sample, field sample 36-48” soil sample. Find contamination in 36-48” above MTCA, field sample 48-60” soil sample. Find contamination in 48-60” sample, field sample 60-72” soil sample. Find no contamination in 60-72” sample above MTCA: Remove 0-60” of soil. Confirmation Sampling. No Further Action.

4.2.1.2 Deep Burial Column Sample Field Screening Analysis

GSA will analyze the 0-12", 12-24", and 24-36" soil samples for each of the columns containing a deep burial column indicated on the sampling grid map. Analyses will be performed using the field kits.

If the 0-12", 12-24", and 24-36" samples yield results for both field kits below their initial action levels, GSA will determine which grid at 0-12", for each column, yields immunoassay kit results closest to the action levels. A sample from the most contaminated 0-12" grid will be sent to the fixed laboratory for definitive analysis. These soil samples will be analyzed by the fixed laboratory for OC and OP pesticides. In addition, one sample from each column from the 24-36" lift will also be sent to the fixed laboratory for definitive OP analysis if the field kits yield results below their initial action levels for the samples identified above.

If any of the lifts analyzed above yields results for either field kit at or above its initial action level, GSA will use the sample analysis decision matrix for the Deep Burial Columns, found in Table 8. Once the extent of contamination has been determined using the field analysis, GSA will send samples to the fixed laboratory and re-calibrate the field test kit action levels, as described in 4.2.1.3.

4.2.1.3 Definitive Fixed Laboratory Analyses and Recalibration of IAA Action Levels

For each column, GSA will utilize immunoassay field kits to determine the extent of contamination in the test plot area, as outlined in 4.2.1.1 and 4.2.1.2. GSA will use these results to determine, for each column in the 12" lift below the deepest 12" lift with contamination (i.e. the first "clean" lift below the contamination), which of the three grids in the "clean" lift has contamination closest to the initial immunoassay decision levels. Contamination in this context will be initially designated when the cyclodiene immunoassay kit exceeds the initial decision level of 100 ppb, and/or when the DDT immunoassay kit exceeds the initial decision level for DDT compounds of 5 ppm. These decision levels will be refined based on the results of definitive analyses and associated re-calibration of the test kits.

Once those "clean" grids are determined (one grid for each column), in Round 1 of the characterization effort, a sample from both the selected grid in the first "clean" lift and the grid from the lift directly above will be sent to the fixed laboratory for analysis. For columns with no test kit results above the action levels, the first clean lift will be 0-12". Since this is the uppermost lift, only a sample from this lift will be sent to the fixed laboratory for analysis. The fixed laboratory will analyze the samples for organophosphorus and/or organochlorine pesticides (Grids from columns 1 and 9 will be analyzed for OC pesticides alone and all other grids will be analyzed for both OC and OP pesticides).

Adjustment of IAA action levels may be applied after the correlation between IAA and fixed laboratory analysis is established. GSA will evaluate the action levels based on the slope of regression (S_{IL}) when IAA results are plotted against the sum of the concentrations found by definitive analysis for the reactivity group for the particular IAA test. The reactivity group is the pesticides to which a particular IAA test is sensitive (see Section 3.3.1 of the Quality Assurance Project Plan for the reactivity groups). If a systematic bias is established (slope different from 1), then the particular IAA action level can be recalibrated dividing the action level by S_{IL}.

Table 8
Decision Matrix for the Deep Burial Columns

Scenario#	0 to 12”	12 to 24”	24 to 36”	Action
1	No	No	No	Confirmation Sampling. No Further Removal.
2	Yes	No	No	Remove 0 to 12” of soil, stockpile as contaminated. Confirmation Sampling. No Further Removal.
3	Yes	Yes	No	Remove 0 to 24” of soil, stockpile as contaminated. Confirmation Sampling. No Further Removal.
4	Yes	No	Yes	Field sample 36-48” of soil. If contaminated above MTCA, field sample next 12” of soil. If next 12 “ of soil are contaminated, repeat field sampling for next 12” of soil. Continue these field sampling steps until contamination is not found above MTCA. Remove 0-12” as contaminated. Remove 12-24” as clean. Remove remainder of contaminated soil from 24” to depth identified by field sampling. Confirmation Sampling. No Further Removal.
5	No	Yes	No	Remove 0-12” as clean. Remove 12-24” as contaminated soil. Confirmation Sampling. No Further Removal.
6	No	No	Yes	Field sample 36-48” of soil. If contaminated above MTCA, field sample next 12” of soil. If next 12 “ of soil are contaminated, repeat field sampling for next 12” of soil. Continue these field sampling steps until contamination is not found above MTCA. Remove 0-24” as clean. Remove remainder of contaminated soil from 24” to depth identified by field sampling. Confirmation Sampling. No Further Removal.
7	Yes	Yes	Yes	Field sample 36-48” of soil. If contaminated above MTCA, field sample next 12” of soil. If next 12 “ of soil are contaminated, repeat field sampling for next 12” of soil. Continue these field sampling steps until contamination is not found above MTCA. Remove contaminated soil from surface to depth identified by field sampling. Confirmation Sampling. No Further Removal.

The definitive data will be compared with the results of the immunoassay kits for the same samples. A correlation will be developed for each column, based on the comparison between the definitive data and the immunoassay kit data. The kit action levels will be "re-calibrated" based on site-specific definitive data.

In Round 2 of this characterization effort, GSA will review the immunoassay results, using the re-calibrated kit action levels and determine, for each column, whether each unanalyzed 12" lift is above or below the kit action levels. GSA will use the re-calibrated kit action levels to determine, for each column, which 12" lift is the deepest sample interval containing contamination above established action levels. GSA will send to the fixed laboratory two samples per column (one sample from each of the two grids not previously analyzed by the fixed laboratory) from the lift below the deepest sample interval containing contamination above a MTCA Method B cleanup action level. This will complete the initial verification of location of the lifts with concentrations above the action levels.

Prior to re-mobilizing field personnel for the initiation of the removal action, GSA will obtain approval from the QAR for the data interpretation and the proposed extent of excavation required.

4.2.1.4 Results of Field and Fixed Laboratory Analyses

Based on the re-calibrated immunoassay kit removal action levels, GSA will depict the soil to be removed and its likely waste characterization. Additionally, the qualitative/quantitative results and associated data qualifiers of both the immunoassay kit samples and the definitive fixed laboratory samples will be listed either on the sketch, or on an attached table of results. The depiction will show the extent of excavation required in the next phase of the project. The proposed excavation plan will be delivered to the QAR one week after receipt of the hard copy of the definitive analytical results. At the discretion of the QAR, additional samples from the archives will be sent for definitive analysis to either refine or establish additional confidence in the excavation plan.

4.2.1.5 Sample Locations

The positioning of the core samples within a grid will first be determined by evidence of surface contamination, e.g., metal frames and concrete blocks in the shallow burial columns. If no physical signs are present, the sampling location will be selected using a random approach.

4.2.1.6 Discrete/Composite Sampling Requirements

These samples will be 72" deep cores (six 12" deep lifts per core), homogenized and split into three subsamples. Two co-located cores will be taken at each location and the lifts from each core homogenized with the respective lift in each pair.

4.2.1.7 Sample Collection and Field and Laboratory Analysis

The samples will be collected with direct push coring equipment. One of the split samples will be analyzed by IAA; another reserved for the fixed laboratory OP/OC analysis; the third sample will be held for QC analysis. Initial action levels, based on the detection limits of the immunoassay kits for the contaminants of concern, will be 100 ppb for the cyclodiene kit and 5 ppm for the DDT immunoassay kit. These levels will be refined based on site conditions and correlation with fixed laboratory analyses.

4.2.1.8 QA, QC and Blank Samples and Frequency

QC samples will be collected at a rate of 10% of the primary samples as per Table 9.

Table 9
Soil Characterization Field QA/QC Frequency

Analyte	Location	Samples	Frequency of Rinsate Blanks	Trip Blanks	10% Field QC Samples (Blind duplicate)	Archived Sample Jars
IAA	Site characteri-zation lifts	162	0	NA	16	0
OP and OC Pesticide	Site characteri-zation lifts	162	1 per day	NA	16	162
OP and OC Pesticide	Performance Evaluation (PE) Sample	Minimum of 2	NA	NA	In first week of laboratory analysis, 4 throughout project	NA

4.2.2 Procedures

4.2.2.1 Sampling Methods

The full length acetate sleeves (containing 36" soil) will be brought to a covered staging area outside of the field laboratory for measuring and cutting. The cores and jars will be protected from direct exposure to sunlight by wrapping in foil. The assignment of depths will be done according to the following guidance based on a test at this site by the push-sampling subcontractor:

1. Because compression is not expected, the first core will be measured into full 12" sections from the ground surface down.
2. Cave-in is not expected, but to the degree it happens, the excess material will all be at the top of the next core. Therefore, the next sleeve will be pushed to a depth of 72 inches from the original ground surface and the 12" section measurements will be taken from the bottom of the sleeve.
3. Excess material at the top will be assumed to be from cave-in and will be discarded.

The direct push cores will be opened, segregated into 12" sections, and placed into precleaned glass jars for homogenization. The respective horizons of each co-located core will be mixed to generate enough soil for a three-way split, with a minimum of 150 grams of soil per sample. The sample size has been determined by laboratory requirements.

The following steps will be used to ensure representative samples and thorough homogenization:

1. Soil will be collected into a dedicated 1/2 gallon glass jar (precleaned as per EPA specifications) with a decontaminated stainless steel spoon for initial debris removal (stones and sticks > 3/8"), crushing , and

mixing. Mixing, crushing, and shaking will be applied as needed to get a visually homogeneous mixture of the soil. The preference is to use a mechanical tumbler so that less labor is needed to get a well mixed sample.

2. If conditions require an alternative, a decontaminated spade and a stainless steel spoon will be used to sample. Also, Ziplock bags may serve as the initial mixing/separating container (kneading with a roller may then be necessary).
3. Final homogenization will be by coning and quartering as follows:
   a) The soil will be drawn up into a cone followed by splitting into four separate cones.
   b) Each small cone will be stirred with a stainless steel spoon to an even consistency.
   c) Two neighboring small cones will be joined after mixing of the individual quarters and mixed and drawn together. The other two small cones will be likewise mixed together.
   d) Finally the two separate mixtures will be joined and mixed.
4. Care will be taken to keep the samples from being exposed to direct sunlight. Jars will be wrapped in foil and/or placed in coolers when not being manipulated.

Samples will be split into three sampling jars precleaned to EPA specifications.

Spoons will be decontaminated between samples. One rinsate blank per day will be generated incorporating new core acetate liners and decontaminated spoons. Spoons used for waste sample handling will be kept segregated from spoons used for characterization and confirmation sampling.

4.2.2.2 Field Measurement Procedures and Criteria

The IAA analysis and criteria for correlation with fixed-laboratory analysis is covered in more detail in Section 4.2.1.3. The IAA analysis requires a 5 gram sample that is extracted with methanol.

Table 10
Soil Characterization Sampling Containers, Preservation, and Holding Time Criteria

Analyte	Method	Sample Type	Preser-vation	Holding Time	Turn-around Time	Type	No. per Sample	Total No. Jars Project+QC+ Archived
IAA		Soil	4°C	14 days to extraction	24 hrs.	4 oz wide mouth	1	162 +16 +0
OP and OC Pesticides	EPA 8081 and 8140	Soil	4°C	14 days to extraction/ 40 days until analysis	72 hrs	8 oz wide mouth	1*	162** +16 +162*
OP and OC Pesticides	EPA 8081 and 8140	Water	4°C	7 days to extraction/ 40 days until analysis	72 hrs	1 L amber, teflon lid	2*	10* (est) +0 +0

* Additional jars are not needed for MS/MSD (for water, a laboratory control sample will suffice).
** Samples for MS/MSD should be selected on the COC or analysis request form.

4.2.2.3 Sample Containers and Preservation Techniques

Sample containers will be obtained from the analytical laboratory as indicated on Table 10.

4.2.2.4 Field Quality Control Sampling Procedures

QC duplicates will be collected at a 10% rate (no QA split samples will be taken). Each sample will be homogenized and split into three replicates and a fourth when the QC sample is taken (an additional split will be created as directed by the Washington DOE representative). One rinsate blank will be taken per day for this confirmation sampling effort. To create a rinsate blank, reagent grade water will be poured over a decontaminated sampling sleeve and a representative decontaminated sampling spoon.

4.2.2.5 Decontamination Procedures

Cross contamination during sample collection will be minimized by the use of disposable gloves which will be replaced for every sample collected. Any non-disposable equipment will be cleaned thoroughly with non-phosphate laboratory detergent and distilled water, and triple rinsed with analyte-free water followed with reagent-grade methanol. Upon completion of sampling, all non-reusable sampling equipment, including gloves, will be disposed of properly. The decontamination rinsate will be collected and stored in a Baker tank. A water sample from the stored water in the tank will be collected and analyzed for OC and OP pesticides, regulated metals, and TSS. If analytical results indicate the rinsate is above MTCA B levels for any contaminant, but below dangerous waste levels, the decontamination water will be disposed of at a local POTW. If results for all contaminants are below MTCA B levels, the decontamination water will be disposed of on-site.

4.3 WASTE CHARACTERIZATION

The two deep burial trenches will be excavated in three lifts, possibly creating six soil contamination groups. The first two are the deep lifts around the bags in the two trenches. The other four lifts will be given preliminary designation (along with the soils to be removed and segregated during gross removal) once the site characterization push-sample results are evaluated and correlated.

A. OC pesticide area (one trench):

1) 0 to 18” (OC Lift 1).
2) 18” to top of bags (OC Lift 2).
3) Bags and soil around bags down to 6” below the bags (OC Lift 3).

B. OP pesticide area (one trench):

1) 0 to 18” (OP Lift 1).
2) 18” to top of bags (OP Lift 2).
3) Bags and soil around bags down to 6” below the bags (OC Lift 3).

4.3.1 Sample Collection Frequency and Rationale

Preliminary and final waste characterization samples will be taken and composited from the focused and gross removal waste drop boxes that will have been segregated by observation, soil characterization-phase IAA analysis, as indicated in Table 11.

4.3.1.1 Sample Locations

The samples will come from the waste drop boxes and existing metal trash cans.

Table 11

Waste Characterization Sampling Schedule

Analyte	Location	Samples	Type	Frequency	Total No. Project Samples
Priliminary Profiling of Focused Removal Soil:					
1. Total OP and OC Pesticide	Waste drop boxes	1	Composite	1 per each of 3 lifts in 2 trenches	6
Preliminary designation of soil in three metal trash cans:					
1. Total OP and OC Pesticide	Trash cans	1	Composite	1 per three cans	1
Final Profiling of Suspected Soil with Pesticide Material:					
1. TCLP endrin/ lindane 2. TCLP metals	Waste drop boxes	2	Composite	1 each, OP and OC Pesticide Material Waste	2
Confirmation of designation of wastes that might fail TCLP for endrin/lindane:					
1. Total OP and OC Pesticide (if more soil is added) 2. TCLP endrin/ lindane 3. TCLP metals	Waste drop boxes	1 (est.)	Composite	1 or more per preliminary designation category	1 (est.)
Confirmation of designation of State-Only Designated Wastes					
1. Total OP and OC Pesticide 2. TCLP metals (TCLP endrin/lindane calc. from total OC)	Waste drop boxes	1 (est.)	Composite	1 or more per preliminary designation category	1 (est.)
Confirmation of designation of Non-designated Waste					
1. Total OP and OC Pesticide 2. TCLP metals 3. carbamates 4. paraquat	Waste drop boxes	1 (est.)	Composite	1 or more per preliminary designation category	1 (est.)

4.3.1.2 Discrete/Composite Sampling Requirements

The soils will be composited, homogenized and split into 4 or 8 subsamples, depending on analytical and QC requirements.

4.3.1.3 Sample Collection and Field and Laboratory Analysis

No split samples will be analyzed by IAA. The 4 sample jars correlate to the total OP/OC pesticide analysis, TCLP (OC and metals), carbamate, and paraquat.

4.3.1.4 QA, QC and Blank Samples and Frequency

QC duplicates will be collected for waste designation samples at a 10% rate (see Table 12). No QA split samples will be taken for this project. No rinsate blanks will be necessary for the waste designation because this is not a trace analysis.

Table 12
Waste Characterization Field QA/QC Frequency

Analyte	Location	No. of Samples	Frequency of Rinsate Blanks	Trip Blanks	10% Field QC Samples (Blind duplicate)	Archived Sample Jars
Total OP and OC	waste drop boxes	7 Prelim. 3 (est.) final wastes	NA	NA	1 (est.)	0
TCLP Lindane \endrin	waste drop boxes	2 (Pesticide Material) 1 (est.) final wastes	NA	NA	1	0
TCLP metals		2 (Pesticide Material) 3 (est.) final wastes	NA	NA	1	0
1.Carbamate 2.Paraquat	waste drop boxes	1 final non-des. waste	NA	NA	1	0

4.3.2 Procedures

4.3.2.1 Sampling Methods

The composite sub-samples will be taken with a stainless steel spoon, polyethylene scoop, and or hand auger (three spoonfuls each) from at least 10 locations at random depths in the drop box and placed into a 1/2-gallon glass jar or stainless steel bowl. Each sub-sample will consist of approximately 100 cm^3. The composite will be stirred to homogenize with each addition.

The following steps will be used to ensure representative samples and thorough homogenization:

1. The first inch or two will be brushed aside with the sampling device.
2. Samples will be taken with a decontaminated stainless steel spoon, polyethylene scoop (for example, VWR 56924-503) or a decontaminated hand auger.
3. Soil will be collected into a dedicated 1/2 gallon glass jar (precleaned as per EPA specifications) for initial debris removal (stones and sticks > 3/8”), crushing , and mixing. Mixing, crushing, and shaking will be applied as needed to get a visually homogeneous mixture of the soil. The preference is to use a mechanical tumbler so that less labor is needed to get a well mixed sample.
4. If conditions require an alternative, a decontaminated spade and a stainless steel spoon will be used to sample. Also, Ziplock bags may serve as the initial mixing/separating container (kneading with a roller may then be necessary).

5. Final homogenization will be by coning and quartering as follows:
   a) The soil will be drawn up into a cone followed by splitting into four separate cones.
   b) Each small cone will be stirred with a stainless steel spoon to an even consistency.
   c) Two neighboring small cones will be joined after mixing of the individual quarters and mixed and drawn together. The other two small cones are likewise mixed together.
   d) Finally the two separate mixtures are joined and mixed.
6. Care will be taken to keep the samples from being exposed to direct sunlight. Jars will be wrapped in foil and/or placed in coolers when not being worked on.

Samples for each waste characterization analysis will be split into 4 to 8 sampling jars precleaned to EPA specifications.

Table 13
Waste Characterization Sampling Container, Preservation, and Holding Time Criteria

Analyte	Method	Sample Type	Preser-vation	Holding Time	Turn-around Time	Type	No. of Jars per Sample	Total No. Jars (Project +QC)
TCLP Endrin/ Lindane	8081	Soil	4°C	14 days to TCLP leaching/ 7 days until analytical extraction/ 40 days to analysis	72 hrs	8 oz wide mouth	Same sample as other TCLP 1	3 (2 Pest. Mat. & 1 waste) +1 (same jar as TCLP Metals)
TCLP Metals	EPA 1311/ 6010 and 7421	Soil	4°C	28 days to TCLP leaching/ 7 days until analytical extraction/ 40 days to analysis	72 hrs	8 oz wide mouth	1	5 (est.) +1
OP and OC Pesticides	EPA 8081 and 8141	Soil	4°C	14 days to extraction/ 40 to analysis	72 hrs	8 oz wide mouth	1	10 (est.)+1 (est.)
Carbamate	Mod. 8141	Soil	4°C	14 days to extraction/ 40 to analysis	72 hrs	8 oz wide mouth	1	1+1
Paraquat	RM-8-10	Soil	4°C	14 days to extraction/ 40 to analysis	72 hrs	8 oz wide mouth	1	1+1

4.3.2.2 Field Measurement Procedures and Criteria

The fixed laboratory results are the definitive method for waste designation and will be the basis for any action taken. These samples will be analyzed by IAA for general information only during the waste characterization phase of the project.

4.3.2.3 Sample Containers and Preservation Techniques

Sample jars will be obtained from the analytical laboratory as indicated in Table 13. The jars will be precleaned for trace organic analysis with each delivery group associated with a lot number and certificate of analysis.

4.3.2.4 Field Quality Control Sampling Procedures

No QA samples are needed for waste profiling. Each composite will be homogenized in a half-gallon glass jar or stainless steel bowl and split into 4 jars (8 jars for sample selected for QC). The QC sample will be randomly selected from one of the five samples taken.

4.3.2.5 Decontamination Procedures

Cross contamination from sample collection will be minimized by using disposable gloves that will be replaced for every sample handled and by decontaminating the stainless steel spoon used for mixing samples. Any non-disposable equipment will be cleaned thoroughly with phosphate-free laboratory detergent and distilled water. Upon completion of sampling, all non-reusable sampling equipment, including gloves, will be disposed of properly. Refer to Section 4.2.2.5 for disposal procedures for decontamination water.

4.4 FINAL SOIL CONFIRMATION

Once the soil has been excavated, as prescribed by the removal decision matrix, final confirmation sampling will be conducted. One sample will be taken from each grid. IAA analysis will be performed in each of the twenty-seven grid areas. Nine samples, one from each column, will be selected for definitve confirmation analysis (the highest IAA result in each column). If definitive confirmation sampling shows that additional excavation is necessary, then further excavation will ensue. Additional field screening analysis may be performed to ensure that the extent of the excavation meets the clean-up standards. Further excavation may be required if analysis (either immunoassay or fixed-lab) shows levels above the Method B cleanup standards in Table 2. Fixed lab analysis only will be used to determine if MTCA cleanup standards are met.

Table 14
Final Soil Confirmation Sampling Schedule

Analyte	Location	Samples	Type	Frequency	Total No. of Samples
1. IAA 2. OP and OC Pesticide 3. Carbamate Pesticide 4. Paraquat	Bottom of excavated columns	1 per column	Discrete sample	9 columns	9 (minimum)

4.4.1 Sample Collection Frequency and Rationale

One discrete surface sample will be taken from the bottom of each of the 9 excavated columns in this confirmation effort (see Table 14). The sample location will be selected randomly unless other evidence indicates that a biased approach would identify the area of highest potential for residual contamination.

4.4.1.1 Sample Locations

Sampling locations within the grids will be determined by the positions of the sources of contamination that were removed (focused approach). If not associated with a hot spot, sampling location within the grid will be determined randomly.

4.4.1.2 Discrete/Composite Sampling Requirements

These will be discrete samples with enough soil taken and homogenized to create a seven-way split with at least 150 grams of soil per sample (1 small jar for IAA, 3 jars for the various pesticides 3 jars for archival)).

4.4.1.3 Sample Collection and Field and Laboratory Analysis

The samples will be collected with a spade, polyethylene scoop, or stainless steel auger. One of the split samples will be analyzed by IAA in the field laboratory and the other sent to the fixed laboratory for OP/OC analysis. The third sample will be reserved for QC analysis.

4.4.1.4 QA, QC and Blank Samples and Frequency

QC samples will be collected at a rate of 10% of the primary samples as per Table 15.

Table 15
Final Soil Confirmation Field QA/QC Frequency

Analyte	Location	Number of Samples	Frequency of Rinsate Blanks	Trip Blanks	10% Field QC Samples (Blind duplicate)	Archived Sample Jars
1. IAA 2. OP and OC Pesticide 3. Carbamate Pesticide 4. Paraquat	Bottom of excavated columns	27	1	NA	3	27

4.4.2 Procedures

4.4.2.1 Sampling Methods

The samples will be collected with a spade, polyethylene scoop, or stainless steel auger.

The following steps will be used to ensure representative samples and thorough homogenization:

1. The first inch or two will be brushed aside with the sampling device.

2. Samples will be taken with a decontaminated stainless steel spoon, polyethylene scoop (for example, VWR 56924-503) or a decontaminated hand auger.
3. Soil will be collected into a dedicated 1/2 gallon glass jar (precleaned as per EPA specifications) for initial debris removal (stones and sticks > 3/8"), crushing , and mixing. Mixing, crushing, and shaking will be applied as needed to get a visually homogeneous mixture of the soil. The preference is to use a mechanical tumbler so that less labor is needed to get a well mixed sample.
4. If conditions require an alternative, a decontaminated spade and a stainless steel spoon will be used to sample. Also, Ziplock bags may serve as the initial mixing/separating container (kneading with a roller may then be necessary).
5. Final homogenization will be by coning and quartering as follows:
   a) The soil will be drawn up into a cone followed by splitting into four separate cones.
   b) Each small cone will be stirred with a stainless steel spoon to an even consistency.
   c) Two neighboring small cones will be joined after mixing of the individual quarters and mixed and drawn together. The other two small cones are likewise mixed together.
   d) Finally the two separate mixtures are joined and mixed.
6. Care will be taken to keep the samples from being exposed to direct sunlight. Jars will be wrapped in foil and/or placed in coolers when not being worked on.

Samples will be split into 4 sampling jars precleaned to EPA specifications (7 jars for QC sample).

4.4.2.2 Field Measurement Procedures and Criteria

The IAA analysis and criteria for correlation with fixed-laboratory analysis is covered in Section 4.2.1.3. The IAA analysis requires a ten gram sample that is extracted with methanol.

4.4.2.3 Sample Containers and Preservation Techniques

Sample containers will be obtained from the analytical laboratory as indicated on Table 16.

4.4.2.4 Field Quality Control Sampling Procedures

QC duplicates will be collected at a 10% rate. Each sample will be split into three replicates. One rinsate blank will be taken for this confirmation sampling effort. To create a rinsate blank, reagent grade water will be poured over the decontaminated sampling spade/auger and a decontaminated sampling spoon.

4.4.2.5 Decontamination Procedures

Cross contamination during sample collection will be minimized by the use of disposable gloves which will be replaced for every sample collected. Any non-disposable equipment will be cleaned thoroughly with non-phosphate laboratory detergent and distilled water. Pesticide grade methanol will be used as a final rinse before air drying in a pesticide-free space and covered with aluminum foil for storage. Upon completion of sampling, all non-reusable sampling equipment, including gloves, will be disposed of properly.

Table 16
Final Soil Confirmation Sampling Containers, Preservation, and Holding Time Criteria

Analyte	Method	Sample Type	Preser-vation	Holding Time	Turn-around Time	Type	No. per Sample	Total No. Jars Project+QC+ Archived
OP and OC Pesticides	EPA 8081 and 8141	Soil	4°C	14 days to extraction/ 40 days to analysis	72 hrs	8 oz wide mouth	1*	27** +3 +27*
Carbamate	Mod. 8141	Soil	4°C	14 days to extraction/ 40 days to analysis	72 hrs	8 oz wide mouth	1*	27** +3 +27*
Paraquat	RM-8-108331	Soil	4°C	14 days to extraction/ 40 days to analysis	72 hrs	8 oz wide mouth	1*	27** +3 +27*
OP and OC Pesticides	EPA 8081 and 8141	Water	4°C	7 days to extraction/ 40 days to analysis	72 hrs	1 L amber	2*	2
Carbamate	Mod. 8141	Water	4°C	7 days to extraction/ 40 days to analysis	72 hrs	1 L amber	2*	2
Paraquat	RM-8-10	Water	4°C	7 days to extraction/ 40 days to analysis	72 hrs	1 L amber	2*	2
IAA	EPA 4041/ 4042 (IAA)	Soil	4°C	7 days to extraction	24 hrs.	4 oz wide mouth	1*	27+3 +0

* Additional jars are not needed for MS/MSD (for water, a laboratory control sample will suffice).
** Samples for MS/MSD should be selected on the COC or analysis request form.

4.5 DECONTAMINATION RINSE-WATER CHARACTERIZATION

4.5.1 Sample Collection Frequency and Rationale

A composite rinse-water characterization sample will be taken from the storage containers with a blind duplicate sample as indicated in Table 17 and 18.

4.5.1.1 Sample Locations

The samples will come from the rinse-water storage container(s).

4.5.1.2 Discrete/Composite Sampling Requirements

A total volume of 1 gallon will be composited (and split into a primary sample and blind QC samples).

Table 17
Decontamination Rinse Water Sampling Schedule

Analyte	Location	Samples per Event	Type	Frequency	Total Number of Primary Samples
1. OP and OC Pesticide 2. 13 Priority Pollutant metals 3. TSS	Rinse-water storage container(s)	1	Composite	1	1

4.5.1.3 Sample Collection and Field and Laboratory Analysis

The sample will not be screened by IAA unless field conditions suggest that a problem may be present.

4.5.1.4 QA, QC and Blank Samples and Frequency

One QC duplicate will be collected, but no QA samples will be collected for the waste designation samples. No rinsate blanks will be necessary for the waste designation samples because the samples are taken directly into the sampling jars.

4.5.2 Procedures

4.5.2.1 Sampling Methods

The samples will be taken by submerging a 1/2 gallon jar (precleaned to EPA specifications), taking an approximate equal volume from each container. The water will then be dispensed to the appropriate sampling

containers for organics analysis. A separate jar will be filled to be dispensed into the metals and TSS sample jars. If the water surface cannot be easily reached by hand, a decontaminated Teflon cup with extension handle will be used to collect the water into the 1/2 gallon jar.

Table 18
Decontamination Rinse Water Field QA/QC Frequency

Analyte	Location	Samples per Event	Frequency of Rinsate Blanks	Trip Blanks	10% Field QC Samples (Blind duplicate)	10% Field QA Samples
1. OP and OC Pesticide 2. 13 Priority Pollutant metals 3. TSS	Rinse-water storage containers	1	0	NA	1	0

4.5.2.2 Field Measurement Procedures and Criteria

These samples will be not be analyzed by IAA.

4.5.2.3 Sample Containers and Preservation Techniques

Sample jars will be obtained from the analytical laboratory as indicated on Table 19. The jars will be precleaned for trace organic analysis with each delivery group associated with a lot number and certificate of analysis.

Table 19
Decontamination Rinse Water Sampling Containers, Preservation, and Holding Time Criteria

Analytes	Method	Sample Type	Preser-vation	Holding Time	Turn-around Time	Type	No. of Jars per Sample	Total No. Jars	Total No. QA Jars
OP and OC Pesticides	8141 and 8081	Water	4°C	7 days to extraction/ 40 days to analysis	72 hrs	1 L, amber glass	2	4	0
Metals	EPA 6020 (ICP/MS)	Water	4°C, pre-preserved with HNO_3 <pH 2	6 months to analysis	72 hrs	500 mL HDPE	1	2	0
TSS	EPA 160.2	Water	4°C	7 days	72 hrs	500 mL HDPE or glass	1	2	0

4.5.2.4 Field Quality Control Sampling Procedures

No QA samples are needed for waste profiling. The QC sample will be sampled in the same manner as the primary sample.

4.5.2.5 Decontamination Procedures

Field sampling artifacts from sample collection will be minimized by using disposable nitrile gloves. Upon completion of sampling, all non-reusable sampling equipment, including gloves, will be disposed of properly. Refer to Section 4.2.2.5 for disposal procedures for decontamination water.

5. SAMPLE CUSTODY AND DOCUMENTATION

5.1 FIELD LOGBOOK

All field notes shall be maintained in a bound book. The Contractor shall document all field activities, location of all materials, suspected additional contamination due to migration and observations. The field notes shall also include a tabulated field conditions sheet for each excavation that includes, as a minimum, the applicable items for the activity to be noted:

- GENERAL INFORMATION

  Date, Start and finish times of the work, Weather Conditions

  Name and Signature of Person making Entry

  Names of personnel present

  Names of visitors

- SITE CHARACTERIZATION INFORMATION

  Field Screening Methods

  Description of Screening (Locations from which samples were taken, etc.)

  Screening and sampling locations shown on a near-scale map relative to a fixed landmark

  Equipment calibration documentation

  Contaminant Action Level

  Field Screening Results, and identify samples with both field and fixed lab analyses

  Fixed Laboratory Definitive Analysis Results

- EXCAVATION INFORMATION

  Type of removal performed (focused or gross)

  Removal grid identification Number(s)

  Date and time of Removal

  Contaminant Type, if known

  Extent of removal (e.g., depth of removal and estimated volume and weight of removed material)

  Location of Confirmation Samples (location of sample given on close-to-scale map in relation to a fixed point, given in “x-y-z” coordinates accurate to ± 3 inches; type of sample; etc.)

Sample Identification Number

Sample Type (composite, grab)

Sample Analysis type (field or fixed laboratory) and results

Water Level, if encountered

- SITE INFORMATION

  Unusual Observations

- CONTAMINATION INFORMATION

  Any Characteristic Odors

  Evidence of Contamination Migration

  Results of "stockpile" (or containerized) waste characterization analyses

  Type of disposal for each contaminated soil stockpile

A copy of each day's field notes shall be submitted to Corps on-site personnel at the completion of each day of project field activity. A copy of the original field notes shall be submitted to the CO as part of the final field report.

Information recorded in other site documents, e.g., sampling logs, will not be repeated in logbooks except in summary form to avoid transcription errors. Any corrections to the logbook or this project's other written documentation will be initialed and dated. All corrections will be shown as a single line through the original. As a minimum, the logbook will contain the date and names of sampling personnel present, a reference to sampling logs, etc., a log of photographs taken, and an indication of the sampling sequence (times). The unused bottom portion of each page will be lined-out, initialed and dated.

5.2 PHOTOGRAPHS

Photographs will be date stamped and logged by a sequential number in the field notebook. A description of the photograph will also be included in the field notebook.

5.3 SAMPLE NUMBERING SYSTEM

The soil samples for screening and laboratory analysis will be designated with sample codes in the following format:

AB-C-DE, for example FR4A-3-612710

	Purpose	Protocol / Options	Examples	Explanation
A	Project phase	1-2 Letters/ FR = Focused removal, W = waste designation, C = characterization, FC = final confirmation, RW = rinse water	FR	Focused removal
B	Column/Row ID or other location identifier	<u>For focused removal</u>: 1 Digit. / 1 or 2 <u>For characterization</u>: 1 Digit + 1 Letter / 1-9 and A-C <u>For waste and water</u> 1 Digit / 1-8 <u>For equipment blanks</u>: 2 Digit alpha/EB	 1 4A 3 EB	 Trench #1 Column 4, Row A Waste Drop Box #3 Equipment Blank
C	Sample depth	1 Digit / Starting core depth, below grade in feet.	3	12” Core from depth 3’ to 4’
D	Date	4 Digit alphanumeric / Month (Jan = 1, Feb =2, Nov = N, Dec = D), Day (2 Digits), Year (1 Digit)	8127	August 12, 1997
E	Daily number	2 Digits / The number in the daily sequence of samples.	09	9th Sample of the day.

See Table 20 for other examples of numbering for primary and QA/QC samples.

Table 20
Example Field Sample Identification

Sample Source	Location/Date	Primary Sample No.	QC Sample No.	QA Sample No.
Third sample of day, with fourth and fifth being QC and QA samples. Focused removal, Confirmation hole #1.	depth of 3-4 feet, 9/6/97.	FR1-3-90673	FR1-3-60674	FR1-3-60675
10th, 11th & 12th sample of day. Characterization grid sample at Column 4, Row A.	depth 5-6 feet, 9/20/97.	C4A-5-920710	C4A-5-920711	C4A-5-920712
4th, 5th, & 6th sample of day, . Confirmation sample, Column 5, Row	2-3 feet, 9/26/97.	FC5B-2-92674	FC5B-2-92675	FC5B-2-92676

5.4 SAMPLE DOCUMENTATION

Each sample will be documented in the permanent record. The record retention is discussed in the following sections.

5.4.1 Sample Labels

See Appendix A for an example label. Sample label information is verified by the laboratory at the time of receipt and all discrepancies with the Chain of Custody Form resolved with the project manager. Labels are discarded with the sample container after analysis.

5.4.2 Sample Field Sheets

See Appendix A for an example sampling log. The sampling logs are attached to the Daily Chemical QC Report (DCQCR) as a means of documenting the samples taken. The logs and DCQCRs are submitted to the COR and are part of the permanent project file.

5.4.3 Chain-of-Custody Records

See Appendix A for an example. The COC forms follow the samples. A copy is retained in the field and attached to the DCQCR. The COC becomes a complete record when signed by the laboratory staff at time of receipt of samples. The completed document is attached to the analytical report, which is submitted to the COR with Summary Chemical Data Quality Reports and becomes part of the permanent project record.

5.4.4 Sample Cooler Receipt Forms

See Appendix A for an example. Cooler Receipt Forms are filled out by the laboratory staff at time of receipt of samples. The completed document is attached to the analytical report, which is submitted to the COR with Summary Chemical Data Quality Reports and becomes part of the permanent project record.

5.4.5 Daily Chemical QC Reports

See Appendix A for an example. The DCQCR is completed daily and submitted to the COR and is part of the permanent project file.

5.5 SAMPLE HANDLING, PRESERVATION, SHIPPING

5.5.1 Soil Sample Processing

Soil samples will be collected by a field technician and brought to the field laboratory area, where a person from the laboratory team will perform homogenization, sample splits, and labeling. Cores containing several lifts will have to be marked with depths and photographed by field personnel familiar with the sample prior to allowing the laboratory person to split the core into sections. Each sample will be entered into a log book that will allow tracking of the number of samples and locations in the refrigerators.

5.5.2 Sample Labeling and Handling for Shipment

All samples will be placed immediately in appropriate containers with labels, sealed tight, surface-wiped, and cooled on ice or placed in a refrigerator. Samples will be labeled with the following information:

- Unique identifying number assigned to the sample for laboratory analysis.
- Date and time of collection.
- Site address and location of sample.
- Name of person taking sample.
- Project name.
- Analysis requested.
- Preservation method.

The sample handling procedures are as follows:

I. Fill out the sample jar label completely and place onto jar. Tape label to jar with clear tape.
II. For soil, insert the sample into the jar with a decontaminated stainless steel spoon, filling approximately three-quarters full. The jar threads should be clean prior to placing lid onto the jar in order to ensure a good seal. For water, fill the jar by submersion or with a sampling cup, leaving approximately an inch at the top. Fill the following number of jars per sample:
    A. Soil (TCLP pesticide and Metals)- fill one 8 oz. jar at least 3/4 full.
    B. Rinsate blanks (Pesticide): Water - Fill two 1 liter amber bottles.
    C. Water (OC/OP Pesticide) - Fill two 1 liter amber bottles.

I. Place each labeled sample jar in a sealable plastic bag.
II. Place each sample in packing material (which will not disintegrate if it becomes wet).
III. Place in cooler with ice at 4 degrees Celsius.
IV. Fill out chain-of-custody form and place in sealable plastic bag taped to inside of cooler lid.
V. Check the ice in the cooler occasionally. Drain water and/or replace ice as needed. Maintain strict custody and seal with custody seals when left unattended.

5.6 CHAIN-OF-CUSTODY

Chain-of-custody documentation is maintained in order to be able to support in a court of law the identity and integrity of the samples. Custody is defined as having the samples in the responsible person's sight, in a controlled area, or in a locked or custody-sealed compartment/container. A chain-of-custody form will be filled out and completed for all samples submitted for analyses. This form will be maintained from the time the sample is collected to the time it is submitted to the laboratory. The chain-of-custody form will be completed in the field and will included sampler's name(s); sample container type and number; date and time of collection; sample collection location(s); analyses to be performed; dates and signatures of those releasing and receiving the samples; date and time samples were received by the laboratory; and the total number of samples received.

The chain-of-custody handling procedures are as follows:

1. Sample custody seals will be used when samples are shipped to the laboratory, when they are delivered to the laboratory after working hours, or when a cooler is left unattended (for example, in the field laboratory trailer). These seals will be signed and dated by the sampler and will be affixed to the sample cooler in a way that would necessitate breaking the seal in order to open the cooler.

2. When using an express shipping service, leave the chain-of-custody form inside the cooler. Do not have the shipper sign the form.

3. Samples for IAA analysis are tracked with the Sampling Log sheets, each of which has a place to document transfer of samples from the field to the field laboratory staff. Samples kept in storage in the field laboratory trailer will be locked in refrigerators except when in use by the field laboratory staff.
4. The laboratory receiving the samples should perform the following tasks:

    - Check the information on the chain-of-custody forms.
    - Check the integrity of the sample custody seals, if applicable.
    - Test the temperature of the water blank enclosed in the cooler to determine the temperature of the samples.
    - Fill out a Cooler Receipt form which will indicate the quality of sample collection, documentation, preservation, and shipping.

An example of a chain-of-custody form, sample custody seal, and cooler receipt form are shown in Appendix A.

5.7 COOLER PREPARATION FOR SAMPLE SHIPMENT

The cooler preparation procedures after the samples have been packed are as follows:

1. Check that all samples are wrapped and secure, and not directly contacting the packages of ice.
2. Check the ice in the cooler one last time. Drain water and/or replace ice as needed. Fill cooler with extra packing material to prevent movement of sample jars relative to cooler and tape drain shut.
3. Place small container (one or two ounces) of water in the cooler, which will be used as a temperature check when the samples are received by the laboratory). Label temperature blank as such.
4. Close lid and tape in two places, encircling the cooler and lid. Use strong (strapping or similar) tape to prevent accidental opening.
5. Place custody seals as per instructions in the previous section.

5.8 LABORATORY DOCUMENTATION REQUIREMENTS

5.8.1 Laboratory Selection

The laboratory selected must be USACE approved and follow the guidance set by the USACE. The laboratory will use Washington State approved methods as per MTCA when applicable.

5.8.2 Deliverables

The laboratory should provide a copy of the following with the analytical report for Quality Control purposes:

- Chain-of custody form.
- Cooler receipt form.
- Analytical narrative (including any problems).
- Blank sample data.
- Matrix spike data.
- Matrix spike duplicate data.
- Instrument calibration check data.
- Duplicate or blank spike results.
- Surrogate data.
- Other QC forms necessary for data validation as outlined in the QAPP.

6. INVESTIGATION DERIVED WASTE (IDW)

Refer to the Waste Management Plan (Section 5) in the RAMP for details. The project activities will result in production of the following waste materials:

1. Sampling and excavation equipment decontamination water.
2. Sampling equipment rinse solvent: methanol.
3. Analytical extraction solvent - methanol.
4. PPE from lab and field.
5. Solid waste from the on-site laboratory.

7. CONTRACTOR CHEMICAL QUALITY CONTROL

7.1 THE QUALITY CONTROL MANAGER ROLES

The QC Manager will follow a three-step process covering a preparatory phase, an initial work phase, and a follow-up activity. This procedure is followed for each definable work process.

7.2 PREPARATORY PHASE

This field sampling plan will be reviewed prior to starting any work phase. The sampling equipment and containers needed will be checked to ensure that sufficient materials are available. The lot numbers of sample containers will be documented.

GSA will ensure that the necessary clearances and permits have been obtained prior to excavation, transportation, and disposal activities are initiated. Analytical results on the soils to be removed will be provided to the transporter by the Site Supervisor.

7.3 INITIAL PHASE

Once a work activity begins, an inspection of work in progress will be made to catch any shortcomings while they are still easy to correct. The field screening techniques for this project are iterative and involve thorough evaluation at each step.

Verification of the proper handling and documentation of the wastes during the disposal phase will be performed at the outset of this activity.

7.4 FOLLOW-UP PHASE

Evaluation of completeness of work and contract compliance is an ongoing process and will be performed by the Site Supervisor during all site activities as well as the end of each phase.

7.5 DAILY CHEMICAL QUALITY CONTROL REPORTS

Daily activities and decisions that affect the quality of the results will be documented on the Daily Chemical Quality Control Reports. All samples taken will be documented. Observations of site conditions which could affect performance of chemical tests will be documented. Deviations from procedures or expected results will be addressed in the daily CQC report, along with corrective actions, if applicable. Documentation of samples taken and correlation with QC samples will be attached to the report. An example report form is provided in Appendix A.

8. CORRECTIVE ACTION

Problems can be encountered with sampling, analytical results, and data interpretation. The following guidance is given for some potential problems with sampling and field screening. Analytical and data interpretation problems are dealt with in the QAPP. The Site Supervisor and/or Chemist Quality Control Manager will be responsible for assessing problems, selecting appropriate actions for implementation, and documenting the rationale and actions taken.

Potential Problem	Corrective Action
Field screening results do not correlate to expectations or field observations.	Data and procedures will be reviewed by the Site Supervisor. The correlation of the IAA and fixed-lab analysis results is a separate work phase that will resolve systematic bias.
Damaging underground utility line(s)	To prevent this occurrence, an underground utility locate will be performed by WSU personnel prior to excavation activities.
Push sampling is ineffective or sampling equipment malfunctions.	An alternate sampling method will be implemented. All equipment and supplies for the alternate method will be kept on-site.
Soil/sediment encountered is non-homogeneous.	Avoid collecting coarse materials. May use a discretionary sample to collect different materials.

9. RELEVANT PROJECT SCHEDULES

Refer to Workplan and Construction Schedule (RAMP Section 1)

10. SAMPLING APPARATUS AND FIELD INSTRUMENTAITON

Sampling equipment will include:

- Decontamination water, including pesticide/interference-free water from lab
- Extra sampling containers
- Cooler temperature blank samples
- Extra custody seals
- Extra labels
- Stainless steel spoons
- 1/2-gallon glass jugs for homogenizing samples
- Ring stands and funnels
- Core sampler
- Teflon cup with extension handle
- Three deacon tubs for sampling equipment
- Waste bucket for rinse methanol
- Brushes
- Non-phosphate laboratory detergent
- Sprayer bottle
- Paper towels

Shipping materials will include:

- Packaging tape
- Black indelible marker
- Hazardous shipping containers, DOT approved, for potentially hazardous samples
- DOT hazard stickers
- "This end up" stickers
- Large and medium ziplock bags
- Custody Seals
- COC Forms
- Labels

PPE will be as described in the Site Safety and Health Plan.

General supplies and equipment will include:

- Camera
- Field notebook
- Sampling log sheets
- DCQCR forms
- RAMP
- H/S certificates
- H/S meeting attendance forms
- Hazardous Materials Response Guide
- NIOSH Pocket Guide to Chemical Hazards
- Flashlight, pager, cell phone, etc.
- Extra batteries for flashlight, etc.
- Safety glasses
- Hard hat and steel toed boots
- Boot covers
- Tyvek coveralls
- Nitrile disposable gloves
- Nitrile gloves