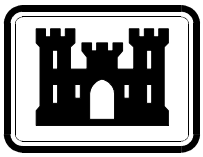
REMEDIAL ACTION MANAGEMENT PLAN

WENATCHEE TREE FRUIT RESEARCH CENTER
TEST PLOT REMEDIATION
WENATCHEE, WASHINGTON



Prepared for the United States Army Corps of Engineers
Contract No. DACA67-95-G-0001-29

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Intro page

SECTION 1
REMEDIATION WORKPLAN AND CONSTRUCTION SCHEDULE

Wenatchee Tree Fruit Research Center (TFREC) Test Plot Remediation
Wenatchee, Washington
DACA67-95-G-0001-029

Prepared by
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Construction Management ♦ Environmental Sciences ♦ Project Management ♦ Engineering

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1. INTRODUCTION

Garry Struthers Associates, Inc. (GSA) has entered into a contract with the United States Army Corps of Engineers (USACE) to prepare a Remedial Action Management Plan for the Wenatchee Tree Fruit Research Center (TFREC) Test Plot Remediation (Contract Number DACA67-95-G-0001-29). GSA further intends to perform the remediation work at the TFREC under a separate Task Order (Number 38). The scope of work for Task Order 38 includes the characterization, excavation, and disposal of pesticide contaminated soil in seven phases: 1) mobilization; 2) focused removal of bags of pesticide; 3) characterization of remediation area; 4) gross removal of pesticide contaminated soil; 5) final confirmation sampling; 6) site restoration; and 7) disposal of contaminated materials.

2. BACKGROUND INFORMATION

The TFREC, located in the southeast portion of Wenatchee, Washington, is contaminated with pesticides in its test plot area and potentially contaminated in its drain field area. The test plot 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. Pesticide burial was performed in three manners: 1) diluted with solvent and poured into the openings of a cinder block; 2) diluted with solvent and poured on the ground surface within a metal frame; and 3) buried at 2-3 feet in its original purchased container.

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/or 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) to remediate the test plot. The test plot is not currently in use. The site is adjacent to a graduate student mobile home, an unpaved access road, and a nearby manufactured home development.

3. PREVIOUS INVESTIGATIONS

3.1 EPA RESEARCH

A review of six journal articles published by EPA researchers in the 1970s was performed by the USACE. 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 method 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, just 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 they 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 the USACE (Figure 1). 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 shall 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.

3.2 WSU AND EPA SITE INVESTIGATIONS

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 of the sampling efforts can be found in Figures 1 and 2. The results of previous sampling efforts are presented 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 the Washington State Model Toxics Control Act (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.

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

Analytical results of samples taken from the test plot area indicated locations where organochlorine pesticides (OC) are a potential contamination concern, and where organophosphorus pesticides (OP) are a potential contamination concern. Additionally, locations within and near the test plot were identified as having minimal to no data indicating contamination. 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

DRAWING FIGURE 1: PREVIOUS SAMPLING LOCATION/ PAGE 1-4

FIGURE 2locations of surface background sampling stations

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
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 #4 & 5	BH1 T404309 (0-	0-2"	E&E	1994	DDE (0")	**5.60E+00**		Location uncertain
					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-	0-2"			Endrin (0")	3.20E-01	J	
					Endrin Ketone (0")	6.90E+00		
					Endrin Aldehyde	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	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	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 close to O-3	TP-2		PRC	1991	DDE	**4.70E+00**	J	OC, OP, and Carbamate
					DDT	1.10E+01	J	
Grid #9 Same as TP-2	TP-3		PRC	1991	DDE	**5.10E+00**	J	OC, OP, and Carbamate
					DDT	**9.80E+00**	J	
Grid #9 close to O-1	TP-4		PRC	1991	DDE	**3.10E+00**	J	OC, OP, and Carbamate
					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	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	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	NO-3		PRC	1991	various pesticides	below detection		Duplicate with NO-4 OC, OP, and Carbamate
Non-Orchard 0.5 miles west of	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.

Table 2
Contaminants of Concern for the Tree Fruit Research and Extension Center, Wenatchee, Test Plot Remediation

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	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	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

organochlorine pesticides during the characterization phase. The area of investigation will be divided into rows and columns, as illustrated in Figure 3.

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 (COCs) 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.

4. REMEDIAL ACTION WORKPLAN

4.1 SAMPLING GRID

The test plot has been divided into nine columns (1-9) and three rows (A-C), making 9 removal columns and 27 sampling grids. Each column corresponds with a discrete potential removal location, based on historic data on disposal locations, as well as past sampling and analysis actions. For the purposes of site characterization, as well as potential removal, each column will be treated as an "exposure unit." Compliance and removal decisions will be made based on exposure unit evaluations.

Grid size has been determined based on statistical analysis of the site and probable hot spot size (5'x10' ellipse), using "Methods for Evaluation of the Attainment of Cleanup Standards, Vol. 1: Soils and Solid Media." (EPA-230/02-89-042, Feb. 1989). The grids will be used as sampling locations, with actual samples taken at biased locations near the disposal locations, when feasible. Figure 3 shows the layout of the test plot area, as designated above.

4.2 WORK PHASES AND DEFINABLE WORK FEATURES

The remedial action will take place in seven steps, where a step is defined as a particular type of action (e.g. gross removal of soil, disposal of wastes). The first step will be the mobilization of equipment, tools, field office and laboratory trailers, etc., establishing the decontamination area and work zones, and the demolition of the shed and removal of the fixed fence. Refer to Figure 4 for the location of the each of the work zones, decontamination pad, and waste storage areas. The second step will be a focused removal of the bags of pure pesticide in the deep burial rows. The third will be a sampling effort designed to complete the characterization of the test plot contamination, as well as initial confirmation sampling. This step will serve to guide the fourth step, a gross removal of contaminated soil. Step five will be final confirmation sampling to verify the completion of removal activities. Step six will be the backfilling of the excavation with clean fill and re-grading the site to the natural grade. The final step will be disposal of contaminated materials. These phases are outlined in more detail below. Detailed procedures and quality control for remedial/demolition work, health and safety, waste handling and transportation, and sampling/analysis are found in the other sections in this RAMP.

Documentation, including field notes and Daily Construction Quality Control Report forms, will be completed daily. Photographs will be taken throughout the duration of field activities. Certified manifests or bills of lading for all contaminated materials disposed of will be submitted to the contracting office's representative (COR).

FIGURE 3 - Sampling grid

FIGURE 4

4.2.1 Mobilization and Preconstruction Phase

Personnel and equipment will be mobilized to the TFREC site, site-specific health and safety orientation will take place, a preconstruction meeting will occur, and appropriate signage posted including "open excavation". The following activities will ensue: the solid waste dumpster will be placed; the nearby existing shed will be demolished followed by documented chemical screening of underlying surface soil with PID; the existing fence dismantled and fence posts removed; office and laboratory trailers will be received; power and water sources will be identified and connected; tree will be removed with the backhoe and a hand-saw if necessary; temporary fencing and work zones will be established; decontamination pad will be constructed; and six roll-off boxes will be received and placed. Refer to Figure 4 for delineation of work zones, trailer locations, and material storage areas. Figure 4 also illustrates the location of the tree to be removed and the existing fence to be removed and replaced with temporary fencing.

4.2.1.1 Decontamination Pad

A designated section of roadway (approximately 20-feet long and 3-feet wide) will be excavated to form a sloping depression toward the road center while not impeding vehicles to continue to drive on the existing road bed. An area including and surrounding this depression will serve as the decontamination pad. The entire decontamination pad area (approx. 8 feet by 25 feet) will be lined with 40 mil HDPE plastic. A water hose will extend to the decontamination pad. Boot wash and vehicle wash will occur over this pad. Decontamination water will be pumped, as necessary, into a polyethylene container stored nearby.

4.2.1.2 Security

A temporary six-foot chain-link fence will be used to secure access to the excavation itself. Barricade tape will be used to surround the project site. An "open excavation" sign will be placed near the excavation.

4.2.2 Focused Removal

GSA will perform a focused removal of the bags of pure pesticide and surrounding soil from the deep burial locations in the test plot. Four removal columns are believed to have the rows of deep burial locations. There are two deep burial areas (each area is located in two columns), each with three rows of spikes consisting of about 12 spikes per row. Locating the deep burial bags by the metal spikes will be used as verification of focused removal locations.

GSA will employ the use of a 580 backhoe with a 1.5 cubic yard bucket for the focused removal action. A front end loader will support this activity by transferring the excavated soils from the backhoe to the appropriate roll-off box. It is important to note that focused removal will only excavate a portion of four columns. Significant quantities of soil will remain in these columns for later characterization sampling.

The soil from 0-18" below ground surface (bgs) at each focused removal location (one trench in columns 2 and 3 is one removal location, one trench in columns 4 and 5 is the other removal location) will be removed and containerized with other soil excavated from 0-18" bgs, for a total of two different containers of 0-18" bgs soil. The soil from 18" down to the buried bags will be removed and containerized with other soil from the same removal location excavated from 18" down to the buried bags. The bags of pure product, and soil 6" below the bags of pure product will be removed and containerized with other bags and soil to 6" below the bottom of the bags. Therefore, a total of six different roll-off boxes will be filled with material from the focused removal: (1) soil from 0-18" bgs in columns 2 and 3; (2) soil from 0-18" bgs in columns 4 and 5; (3) soil from the columns 2 and 3 deep

burial 18" bgs-top of bag; (4) soil from the columns 4 and 5 deep burial 18" bgs-top of bag; (5) columns 2 and 3 bags and soil down to 6" below bags; and (6) columns 4 and 5 bags and soil down to 6" below bags. It is expected that the material placed in roll-off boxes (5) and (6) will be considered "soil with pesticide material" and be disposed of as such, i.e., sent for incineration.

No sampling will occur prior to excavating the focused removal rows. Refer to the Sampling and Analysis Plan for sampling and analysis details.

If samples collected from the bottom of the trenches indicate that contamination above the action levels still exists, the COR may direct GSA to excavate additional soil in 6-12" increments.

The roll-off boxes will be placed on 10-mil visqueen (or equivalent). Visqueen will be placed in a manner that prevents (to the maximum extent practicable) the soil from spilling onto the ground while it is being placed into the boxes. GSA will label each container, using a paint marker or spray paint, with a description of the material in the container including:

- Focused removal material
- Column and/or grid from where material was removed
- Depth of material prior to removal (e.g. 0-18", 18"-bag)
- Date

Covered boxes will be placed on top of 10-mil visqueen (or equivalent) and stored in a designated contaminated soil storage area. The contaminated material storage area will be delineated by barricade tape.

4.2.3 Characterization of Remediation Area

After the focused removal, GSA will perform sampling and analysis to complete the characterization of the test plot area prior to the gross removal of contaminated soil. GSA will collect core samples from each grid. Grid sampling locations will be biased, based on information available on experiment locations within each grid.

This approach is defined by Ecology as "Focused Sampling." Focused Sampling means the selective sampling of areas where potential or suspected soil contamination can reliably be expected to be found if a release of a hazardous substance has occurred. Since the number of sample locations was determined using statistical analysis of potential hot spots, and since samples will be collected from 0-72" below initial grade, the USACE believes that the extent of contamination will be effectively determined and the contamination will be remediated.

GSA will use a direct push sampling technique with polypropylene sleeves to collect 0-36" and 37-72" cores from each grid. Soil samples will be collected using one-inch diameter probe rods with a probe driven soil sampling device attached to the end that allows for the retrieval of continuous soil cores up to approximately 2-inches in diameter and 4-feet in length. Test probes will be advanced using Summit's Geoprobe sampling unit which is equipped with a subsurface probe system. Soil samples will be removed from the device and transferred immediately to a GSA representative on-site.

After pulling the cores from the ground, they will be taken to the on-site laboratory trailer, placed on their side (in its sleeve), measured, and divided into 12" lifts (beginning with the 0-12" lift). Each 12" lift will be homogenized, split into three (3) equal volumes, and placed into separate, marked, sample containers. GSA will push a second boring co-located to the first boring to collect the necessary sample volumes. The soil from comparable lifts of both borings will be homogenized prior to containerization of the samples.

A test push sampling event was conducted on July 14, 1997, by Summit Enviro Solutions for GSA. The sample recovery was approximately 100 percent. Based on the results of this test, the need to implement an alternate sampling technique is unlikely. However, if the direct push sampling technique proves to be unfeasible or ineffective, the alternate sampling procedure is manual advancement of the Geoprobe soil sampling device using a slide hammer. The necessary equipment including the slide hammer will be kept on-site for the duration of the soil characterization phase of work.

Soil screening for DDT (Draft SW-846 Method 4042) and Cyclodiene insecticides, will be performed using field screening as the primary soil characterization method in this phase. Each lift shall have at least three (3) split samples. One shall be used with the field screening kits. 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 fixed laboratory confirmation analyses prior to making removal decisions. The other split samples shall be stored in a refrigerator (or on ice) at 4±2°C and may be designated by the Quality Assurance Representative (QAR) for definitive analysis by a fixed laboratory. The 0-12" below ground surface (bgs) soil samples from each of the shallow-only burial columns indicated on the sampling grid map will be analyzed using the field kits. GSA will also analyze the 0-12", 12-24", and 24-36" bgs soil samples for each of the columns containing a deep burial column indicated on the sampling grid map. Analyses shall be performed using the field kits.

Refer to the Sampling and Analysis Plan for sampling and analysis details.

GSA will provide to USACE for review a 3-dimensional map/drawing of the removal area with the columns shown, which denotes the soil to be removed and its likely waste characterization, based on the re-calibrated immunoassay kit removal action levels. 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 map/sketch will show the extent of excavation required in the next phase of the project.

Decontamination water generated during this phase will be collected and stored in a holding tank.

Upon completion of sampling activities, probe holes will be abandoned by backfilling with soil or placing dry bentonite into the probe hole, the upper surface of which will be hydrated. Ground surface will be sealed using approximately 6 to 12 inches of the surrounding native soil.

4.2.4 Gross Removal

The main portion of the remedial action will be accomplished using a 580m backhoe to effectively remove soil from the 10'x33' removal columns to depths of 12", 24", 36", 48", 60", or 72" (±3"), while minimizing the removal of soil beyond what is required by the sampling results in the previous phase. The removal will be conducted in accordance with the sampling results found in the previous phase, as well as with the removal decision matrices found in Tables 3 and 4. GSA will use standard excavation techniques. GSA will also use sprayed water for dust suppression in the area of investigation and will coordinate water supply issues, as well as other utility issues, with WSU's on-site personnel.

GSA will, to the maximum extent practicable, use excavation techniques that minimize the cross contamination from one excavation column to another, or contact between contaminated soil and uncontaminated soil.

Table 3
Removal Decision Matrix for Shallow Disposal
(Contamination above MTCA Method B/Field Kit Action Level at depth)

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 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 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.

Table 4
Removal Decision Matrix for Deep Burial
(Contamination above MTCA Method B/Field Kit Action Level at depth)

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 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 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.

Excavated soil will be placed in roll-off containers. Excavated soil will be segregated, consistent with the site characterization analysis and the removal decision matrix, in the following manner:

Group #1 Soil with Pesticide Material

Group #2 Endrin/Lindane Contaminated Soil that fails the TCLP analysis

Group #3 State-only Designated Waste

Group #4 Non-Hazardous Contaminated Solid Waste (above MTCA B levels but not designated)

Once the soil has been excavated, as prescribed by the removal decision matrix, final confirmation sampling will be conducted by GSA as outlined in the next section.

4.2.5 Final Confirmation Sampling

Once the gross removal has been completed, GSA will collect one sample from each grid (taken as a surface sample from the post-excavation surface, homogenized and split into at least three containers (refer to the Sampling and Analysis Plan). One of the split samples from each grid will be analyzed by the field analysis kits (immunoassay). If any of the contaminants exceed the re-calibrated immunoassay kit decision level, the COR will determine the extent of additional excavation and/or definitive analysis in a fixed laboratory that may be required. The COR will make the final determination.

If none of the contaminants exceed the cleanup standards based on the results of the re-calibrated field kits, GSA will use the field kit results to determine the grid in each column with contamination levels closest to the re-calibrated immunoassay kit decision levels.

The split sample from the most contaminated grid in each column (nine total samples) will be sent to the fixed laboratory for final definitive analysis confirmation. Samples will be analyzed for pesticides of concern (Total OP, Total OC, carbamate-urea pesticides, and paraquat). Results from these analyses will be reported to the QAR, as well as included in the Removal Action Completion Report.

If fixed laboratory confirmation sampling shows remaining contamination in the removal area compared with the site action levels (MTCA Method B), GSA and the COR will determine the extent of additional excavation required. The COR will make the final determination.

All sampling equipment will be decontaminated before and after each sampling event. Decontamination will proceed as follows:

1. Disassemble equipment
2. Wash with non-phosphate detergent (alconox) and tap water
3. Rinse with tap water
4. Rinse with deionized or distilled water
5. Rinse with isopropyl alcohol (use a squirt bottle)
6. Triple rinse with deionized or distilled water
7. Rinse with certified organic free (HPLC) water

4.2.6 Waste Characterization Sampling for Disposal

Waste characterization samples will be taken from each soil waste stream. Each waste characterization sample will be analyzed for TCLP endrin/lindane, total OC pesticides, total OP pesticides and TCLP metals. Those soil thought to be above MTCA B levels but otherwise undesignated may be analyzed for total carbamates and totals for paraquat.

Three metal garbage cans with lids are located near the gate on the northeast side of the test plot area. The cans contain soils that may be contaminated with pesticides. The soil within the cans will be sampled (one sample taken as a composite of the soil in the three cans and homogenized). For waste designation purposes, the composite sample will be analyzed for TCLP pesticides, total OC pesticides, total OP pesticides, total carbamates, totals for paraquat and TCLP metals. The contents of the cans will be consolidated with other soils from the removal action that exhibit a similar analytical profile. The cans will be disposed of in a manner consistent with local, state, and federal regulations.

4.2.7 Backfilling, Grading, and Revegetation

If definitive confirmation sampling shows that additional excavation is not necessary, GSA will backfill the excavation with clean imported ("virgin") soil. The soil cover placed as backfill will be compacted to approximately 85%, or as attainable by rolling equipment used to place fill material into the excavation (e.g., backhoe) over the site a minimum of three times. The finished surface will be reasonably smooth, compacted, and free from irregular surface changes.

After completing the backfilling and grading at the site, GSA will revegetate the site with imported topsoil and by hydroseed application. The history of the topsoil used will be provided. The surface of areas to be seeded will be finished to a smoothness suitable for the application of seeding material. Seed in the amount per acre designated, wood cellulose fiber mulch and tackifier/binding agents at the rates recommended by the manufacturer for the specified fiber mulch used, will be combined with water to provide a slurry, and application will be performed in such a manner that the liquid carrier will uniformly distribute the material over the entire area to be seeded. The seed area will be watered after seeding and the soil moistened to a depth of 2 to 4 inches.

If the seeding season is unusually dry so that water will be required to establish vegetation, watering will be necessary during the seeding season. GSA will advise WSU-TFREC of the watering requirements for the re-vegetated Test Plot Area. WSU-TFREC will be responsible for watering and maintaining the test plot vegetation after GSA completes the site work.

4.2.8 Disposal of Contaminated Materials

All disposal will be conducted in accordance with the Superfund Off-Site Rule. Refer to the Sampling and Analysis Plan (Section 2) for waste designation procedures. Refer to the Waste Management Plan (Section 5) for waste disposal procedures, facilities, and recordkeeping.

5. EQUIPMENT

The following is a list of equipment and tools to be used on this project (also refer to equipment list in the Field Sampling Plan):

- Backhoe (580 Case)
- Pickup truck
- Flat bed truck
- Truck or ATV for hydraulic push sampling
- Diaphragm pump
- Poly Storage Container
- Hand Auger
- Geoprobe unit
- One-inch diameter probe rods
- Decontamination equipment (5-gallon buckets, brushes, squirt bottle)
- Miscellaneous hand tools

6. PERSONNEL CONTACTS

Title	Name	Telephone Number
U.S. Army COE		
Contracting Officer's Representative	Bill Brooker	(206) 764-2969 ext. 131
Construction Project Engineer	Kim Converse	(206) 764-3482 (206) 663-7423 pager
QA Representative	Greg Gervais	(206) 764-6837
Project Manager	Ralph Totorica	(206) 764-6682
GSA		
Manager, EHS	Baz Stevens	(425) 519-0300 ext. 201
Site Safety & Health Manager (SSHM)/QC Manager	Baz Stevens, CIH	(425) 519-0300 ext. 201 (206) 975-9280 pager
Site Supervisor/Site Safety & Health Officer (SSHO)	Fred Luck	(425) 519-0300 ext. 205 (206) 975-6339 pager
24-hour On-call Representative	Baz Stevens	(206) 283-9297 home
Alternative 24-hour On-call Representative	Fred Luck	(425) 413-9379 home

7. CONSTRUCTION SCHEDULE

The construction schedule for the TFREC is provided on the following page.

CONSTRUCTION SCHEDULE FOR THE WENATCHEE TREE FRUIT RESEARCH CENTER
TASK ORDERS #29 #38