Guidance for Remediation of Petroleum Contaminated Soils

Washington State Department of Ecology
Toxics Cleanup Program

Revised November 1995
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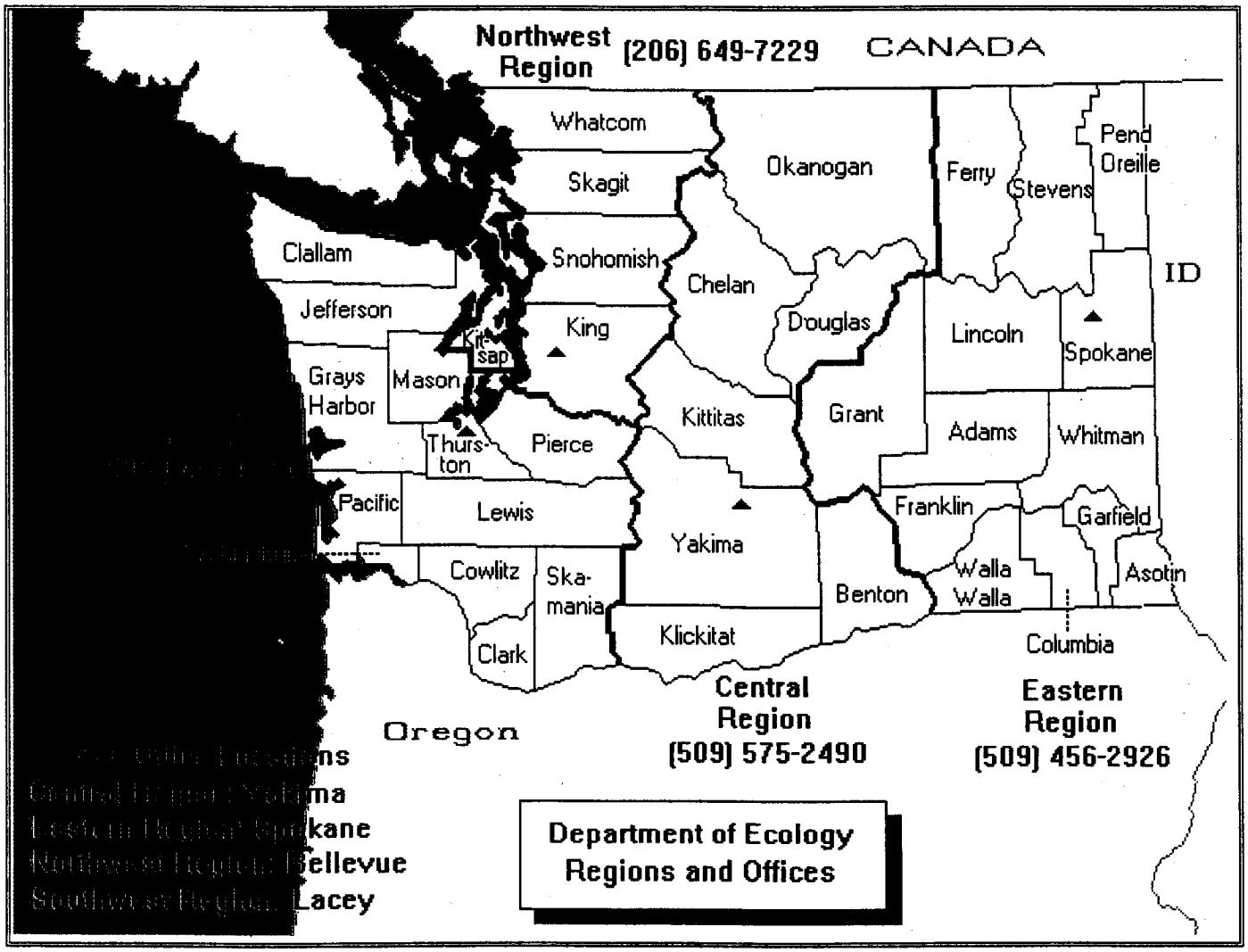

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Toxics Cleanup Program
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FORWARD

In this revised edition of the Guidance for Remediation of Petroleum Contaminated Soils, previously titled *Guidance for Remediation of Releases from Underground Storage Tanks*, the Department of Ecology has made the following changes to the July, 1991 edition.

- Changed the name of the guidance to better describe the type of sites for which it can be used.
- Updated names and phone numbers in text and appendices.
- Updated information to reflect changes in regulations.
- Referred to IRAP Guidance for preparing reports.
- Modified the language on Method B cleanups.
- Updated information on the permits you might need at a leaking underground storage tank site.
- Provided more information on sampling. To do this we provided a typical leaking underground storage tank (LUST) site scenario. Within that scenario we described two different sampling strategies and provided an example of a site map and a table showing how you might format your sampling results.
- Decided not to include several of the appendices that were in the first version of the Guidance and not to add the Total Petroleum Hydrocarbons Analytical Methods appendix. The main reason we are not including these appendices is because they are likely to change in the near future. They are available separately.
- Decided that all sites that use statistical methods to determine cleanup levels should use the same guidelines. Therefore, we removed the Statistical Guidance for Petroleum-Contaminated Soil Cleanup Level Determinations (Appendix E) and referred cleanup contractors to the Statistical Guidance for Ecology Site Managers (document number 92-54).
- In the first edition of the guidance, the appendix on technologies was very similar to the information given on technologies in the main body of the guidance. Therefore, we modified the Technologies Section and deleted the technologies appendix.
- Removed the Section on Regional Treatment Centers. This section contained information on evaluating and permitting regional treatment centers. For information on how to become a permitted regional treatment center contact your jurisdictional health department. Appendix H in this guidance is a list of regional treatment centers that take petroleum contaminated soils.

OTHER ECOLOGY DOCUMENTS

The following documents provide valuable information on site remediation and preparing cleanup reports.

Guidance for Site Checks and Site Assessments for Underground Storage Tanks -- Publication No. 90-52

This guidance provides information on the activities necessary when closing or removing underground storage tanks. Some of the information in this guidance may be of use to anyone working on underground storage tank sites. Information such as health and safety requirements, field sampling procedures, and quality assurance and quality control requirements is provided.

The Model Toxics Control Act Cleanup Regulation -- Publication No. 94-06

This document contains the rules for cleanup of toxic substances in Washington State.

To obtain copies of the above documents call Ecology's Publications Distribution Office at (360) 407-7472.

Guidance on Preparing Independent Remedial Action Reports -- Publication No. 94-18

This guidance provides information on how to prepare independent cleanup reports. Ecology strongly recommends that, if you wish to submit an independent cleanup report for review by Ecology, you follow the guidelines in this document. To obtain a copy of this document call (360) 407-7224.

ECOLOGY TDD PHONE NUMBERS

Ecology's TDD phone numbers are listed on the inside of the front cover and in Appendix F.

PRIVATE RIGHTS OF ACTION

If you intend to seek a "Private Right of Action" against other potentially liable persons for a share of your cleanup costs, then you should refer to Chapter 70.105D.080 and The Model Toxics Control Act Cleanup Regulation, WAC 173-340-550(5).

1.0 REMEDIAL ACTIONS FOR PETROLEUM CONTAMINATED SOILS

1.1 INTRODUCTION

In Washington State contaminated sites may be cleaned up (remediated) using one of two processes; the formal process or the independent cleanup process. The formal process requires an order or consent decree and direct oversight by the Department of Ecology. Once a site has entered into the formal process, the provisions in the order or consent decree take precedence over any guidance in this document.

The independent process was established to allow owners of contaminated sites to proceed with remediation of the site independent of Ecology's direct involvement. **This guidance document was written for owners who wish to remediate their sites using the independent process.**

The Guidance for Remediation of Petroleum Contaminated Soils (PCS) is intended to provide the information needed by consultants, owners, operators, and government agencies to clean up contamination caused by spills, overfills or leaks of petroleum, most often from underground storage tanks and associated piping. It provides information on reporting, sampling strategies, cleanup standards, and treatment and disposal options. This information should help contractors carry out cleanup actions at petroleum contaminated sites without Ecology's direct oversight.

Ecology staff will use this guidance document, the Model Toxics Control Act Cleanup Regulation, and the Guidance on Preparing Independent Remedial Action Reports to evaluate all independent remedial actions. It is in the property owner's and cleanup contractor's best interest to follow these guidance documents as closely as possible. To learn how to obtain a copy of these documents see page v.

The rules governing reporting and remediation of releases from underground storage tanks (USTs) that are regulated by 173-360 WAC differ somewhat from the rules governing reporting and remediation of releases from USTs not regulated by 173-360 WAC ("non-regulated" USTs). We have attempted to point out these differences in the appropriate sections of this guidance.

This guidance is not intended for sites containing non-petroleum hazardous substances. If you want to clean up a hazardous waste or non-petroleum site there are other regulations of which you need to be aware. Non-UST and non-regulated UST petroleum contaminated sites are subject to the Toxicity Characteristics Leaching Procedure (TCLP) under the Dangerous Waste regulations (See subsection 1.6.4 of this document).

1.2 STATE AND FEDERAL REGULATIONS

1.2.1 Underground Storage Tank Regulations, Chapter 173-360 WAC

Owners and operators of "regulated" underground storage tanks must comply with the Washington State Underground Storage Tank (UST) Regulations, Chapter 173-360 WAC. These regulations govern USTs up until the time a release is confirmed. Once a release is confirmed, the owner must follow the regulations established under Chapter 173-340 WAC.

1.2.2 Cleanup Regulations, Chapter 173-340 WAC

The Model Toxics Control Act (MTCA) is the primary statute governing cleanup of leaking underground storage tank (LUST) sites in Washington State. At sites where there has been a confirmed release, the owner/operator must comply with the MTCA Cleanup Regulations, Chapter 173-340 WAC. Appendix A of this document is the primary section of the cleanup regulation containing the rules specific to remediation of regulated UST sites. However, other sections of the cleanup regulation may also apply to these sites. Ecology's Toxics Cleanup Program (TCP) is responsible for implementation of both the Underground Storage Tank and the MTCA Cleanup regulations.

On Washington State Native American lands, Chapter 40 Code of Federal Regulations Part 280 must be followed. EPA is responsible for implementation of UST and LUST regulations on tribal lands. To report a leaking underground storage tank on tribal lands contact the Environmental Protection Agency's Washington State Operations Office at (206) 753-9540.

1.3 MODEL TOXICS CONTROL ACT REQUIREMENTS

1.3.1 Releases from Underground Storage Tanks

UST owners and operators must report all releases, spills and overfills from regulated underground storage tanks and from heating oil USTs over 1100 gallons to Ecology within 24 hours. Releases, spills, and overfills from all other USTs (those not regulated by Chapter 173-360 WAC) must be reported to Ecology within 90 days of discovery (see Section 1.3.3). All release reports should be made to the Ecology regional office that is responsible for the area in which the release occurred (See map on inside of front cover or Appendix F).

"Release" means any intentional or unintentional entry of any hazardous substance into the environment, including but not limited to the abandonment or disposal of containers of hazardous substances (WAC 173-340-200).

Also within 24 hours of discovering a release, the owner or operator must remove as much product from the tank as possible to prevent further release, and must eliminate immediate fire or vapor hazards. Product must not be washed into storm sewers. (Please note that under WAC 173-360-630, UST site assessors in addition to owners and operators must also report

confirmed releases. Some health departments may also require early notification of an UST release. Under Chapter 90.56 RCW, Ecology must be notified immediately if petroleum enters surface or groundwater.)

UST owners and operators are responsible for preventing petroleum hazardous substances from spreading, for monitoring and mitigating fire and safety hazards posed by vapors and free product, and for reducing the threat posed by exposure to contaminated soils as soon as possible, but no later than 20 days after confirming the release. If contaminated soil is found in contact with the groundwater, or the contamination extends below the lowest sampling depth, groundwater samples must be taken to test for the presence of contamination. If free product is present, the owner or operator must begin removing it as soon as possible.

1.3.2 Reporting Releases From Regulated USTs

The following reports are required when there is a release from a regulated UST. See WAC 173-340-450 (4) for more specific information on reporting requirements.

Required Reports:

- Initial notification by telephone within 24 hours of release confirmation. At this time the site will be added to the LUST data base and will appear on the statewide LUST report published by the agency. Minor releases may not be added to the data base, but should be reported;

- Status report by telephone or in writing within 20 days of release confirmation, on actions taken or planned;

- Written site characterization report within 90 days of release confirmation. This report defines the lateral and vertical extent of soil and groundwater contamination; and

- Written independent cleanup action report within 90 days of completing a cleanup action (see Subsection 1.3.5 "Preparing Cleanup Reports"). The site characterization report and the cleanup action report can be combined if cleanup is complete within 90 days of release confirmation. If cleanup is not complete at the time the site characterization report is submitted, the owner must submit a final report on subsequent investigations and cleanup actions within 90 days of completing those actions.

Remedial Investigation/Feasibility Study (RI/FS) Report

An RI/FS needs to be done at a site if:

a. there is evidence that the release has caused hazardous substances to be present in the groundwater in excess of cleanup levels (See Table IV). If groundwater is contaminated above state groundwater standards for benzene (1 ppb under WAC

173-200)[1] or above cleanup standards for other hazardous substances, the owner or operator must conduct a state remedial investigation/feasibility study (WAC 173-340-450(5)(a)(i)). The scope of the study will depend on the individual facility, but sufficient information must be collected and evaluated to allow selection of a cleanup remedy.

b. free product is found; or

c. otherwise required by Ecology.

If an RI/FS is necessary, the information collected during the RI/FS should be submitted to Ecology as soon as feasible and may be included with other required reports. For specifics on what elements an RI/FS must include see Appendix A, WAC 173-340-450(5). **NOTE**: If your site has groundwater contamination above cleanup levels and requires an RI/FS, you may need more guidance than this document provides.

1.3.3 Reporting Releases From Non-Regulated

For releases from underground storage tanks that are not covered by WAC 173-340-450, owners and operators must report the release to Ecology within 90 days of its discovery. However, if petroleum enters surface water or groundwater, Ecology must be notified immediately. Any person who conducts an independent interim action or cleanup action must submit a report to Ecology within 90 days of completing the action.

1.3.4 Site Characterization

The first step in a LUST cleanup, after dealing with the immediate problems caused by the release, is to characterize the site. The site characterizing process determines the extent of the contamination and provides the basis for a remediation strategy. Often a site check or site assessment has already been completed for the site. If so, at least some of the information you will need to characterize the site should be available.

If insufficient or no information has been gathered about the site, you should begin by obtaining information about the release. Answers to the following questions will get you started.

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[1] One part per billion benzene is considered an "action level." This means that if you find benzene at this level you must investigate further to make certain the contamination is not greater than the cleanup level (5 ppb for groundwater).

1. What contaminants were released at the site?

It is essential to know the characteristics of the contaminants such as phase partitioning, mobility, and degradation in order to predict their behavior in the subsurface and to choose the best corrective action technology.

2. How much product was released?

Knowing the amount released can help the contractor predict whether the contaminant has reached the saturated zone.

3. How much time has elapsed since the release?

Degradation, volatilization, and flushing from infiltrating rainfall cause change in composition of contaminants over time. These changes, called weathering, may determine your approach to sampling and your choice of remediation technology. For example, if the release occurred long ago, you would not expect to be able to use field observation and screening to pinpoint sampling locations.

4. How was the release discovered?

Answers to this question could provide information on the extent and distribution of contamination in the subsurface.

If an UST site assessment has been completed previously for the site, you should have some background information on the site and the results of soil samples. The minimum soil samples required for a site assessment are outlined in Table 5-2 of the Guidance for Site Checks and Site Assessments for Underground Storage Tanks. If the site assessment information adequately characterizes the release, no further sampling will be required for the site characterization report. However, the consultant should determine the exact number of samples needed to adequately characterize the site based upon the specific conditions of each site. See Section 1.4 of this document for additional information on sampling.

1.3.5 Preparing Cleanup Reports

When preparing interim and final cleanup reports, Ecology strongly recommends that site owners follow the Guidance on Preparing Independent Remedial Action Reports. **To obtain a copy of this guidance call the LUST staff at the appropriate regional office (see inside of front cover or Appendix F) or call Ecology Headquarters at (360) 407-7180.**

1.3.6 Financial Assistance

The Model Toxics Control Act allows Ecology to help owners and operators with the costs of investigation and cleanup. The funding must achieve "a substantially more expeditious or enhanced cleanup than would otherwise occur" and prevent or mitigate "unfair

economic hardship". Ecology can pay costs only if it has formally agreed to do so before the work starts.

To request financial assistance for a LUST cleanup, an owner or operator must complete the form, "Application for a consent decree and financial assistance for cleanup of releases from underground storage tanks," which is available from LUST staff at Ecology regional offices (Appendix F). Ecology will require copies of Federal Income tax statements from the previous three years in order to evaluate the owner's or operator's eligibility for financial assistance.

A determination of eligibility is not a funding commitment. Actual funding will depend on the availability of funds. Currently funding for LUST Financial Assistance program is extremely limited.

Local governments may be eligible for remedial action grants from Ecology's Waste Management Grants Section. To be eligible for a grant, the local government must be a potentially liable person and be under an order or decree under MTCA. For additional information contact the Grants Section at (360) 407-6060.

1.4 SAMPLING AND ANALYSIS

Samples must be taken and analyzed in order to characterize contamination and to plan and evaluate remedial actions at a site. Adequate sampling is required in order to determine the type and extent of contamination and to determine final cleanup status.

It is extremely important to carefully document all sampling activities at the site. As you proceed with the site characterization and remediation processes you should document your observations. Make note of what you see and smell, the methods you use to collect soil or groundwater samples, why you take the number of samples you do, etc. Ecology strongly recommends that you include this information in your reports along with a table of the analytical results of your sampling activities and a map showing sampling locations. See FIGURES I, II, and III for examples of the type of site map and sampling results Ecology would like to see in your cleanup report(s).

1.4.1 Sampling and Analysis Plans

A sampling and analysis plan must be prepared before beginning any sampling activities that are part of an investigation or remedial action at a contaminated site, unless otherwise directed by Ecology and except for emergencies. Requirements for sampling and analysis plans are described in WAC 173-340-820 (see Appendix C). Your sampling and analysis plan does not need to be submitted to Ecology.

1.4.2 Soil Sampling

The purpose of soil sampling is to provide the information needed to decide whether soil contamination exists at unacceptable levels and if so, to define the extent of the contamination. If it is necessary to develop a plan for remedial actions, the soil sampling must provide sufficient information in quality and detail to make informed planning decisions. Laboratory analyses of soil samples should include the analyses listed in Table II.

Approaches to Soil Sampling

At many leaking underground storage tank sites, sampling has already been conducted as part of a site check or site assessment. Ecology's Guidance for Site Checks and Site Assessments for Underground Storage Tanks describes where these samples should be taken (see Table 5-2 of that document). The initial sampling that confirms a release is only a starting point for the investigation of LUST sites. Further sampling will normally be necessary to characterize the nature and extent of contamination.

Two approaches are available for conducting sampling of soil at LUST sites; the focused approach and the area-wide approach.

The Focused Approach

The focused approach can be used at sites where reliable indicators (such as soil staining or the presence of vapors) make it possible to identify areas of soil contamination, either visually or with field instruments, and to track those areas from the source to their boundaries in any direction. Reliable indicators are usually present at sites where there has been a recent release to soil. If areas of contamination can be identified and tracked through the surrounding soil with reliable indicators, sampling may be limited to these areas.

Note: Sampling depth is often at the lowest point of the interface between the backfill material and native soil. The contrast in texture between the less permeable native soil and the relatively coarse-grained backfill material (customarily pea-gravel, crushed rock or sand) frequently impedes the progress of a released substance.

If you use the focused approach to sampling, your cleanup report should include a discussion of why this approach was suitable for this particular site. **It is your responsibility to convince Ecology that the focused approach enabled you to find all of the contamination.**

TWO NOTES:

1. Normally, Ecology would expect focused sampling to occur in combination with soils excavation, rather than at sites where in-situ treatment is contemplated.

2. If you use the focused approach to sampling, use the Method A Cleanup Standards listed in TABLE IV to determine cleanup levels. Do **not** use the

Statistical Guidance for Ecology Site Managers referred to in the Area-wide Sampling section below.

The "typical scenario" below provides owners and contractors with an example of the focused approach to sampling. It is not in any way meant to describe the activities at all LUST sites.

A Typical Scenario

After removal of an underground storage tank, the contractor observes soils staining and smells gasoline vapors. The contractor reports the release to the site owner and to the appropriate Ecology regional office. The owner hires a contractor to remediate the site.

The cleanup contractor takes any immediate actions necessary to contain the release and then proceeds with site characterization. The contractor uses field observation and field instruments to locate contamination and then excavates in those areas. He continues to use field observation and instruments to locate and remove contaminated soils from the excavation pit. When the contractor is unable to locate any more contamination using field instruments, he stops digging and takes samples from the bottom of the excavation pit (under previous tank, piping, and dispenser areas) and from the walls of the excavation pit (See FIGURE I). These samples are sent to the lab to determine if cleanup levels have been met.

When excavating, the contractor places excavated soil in segregated piles if possible. For example, the most contaminated soil is placed in one pile, moderately contaminated soil in a second pile, and the least contaminated soil in a third pile. The contractor then takes discrete samples from each of the soil piles. These samples are sent to the lab to determine which soil piles exceed the cleanup level and which treatment options should be considered. See Excavated Soils section below for additional information. Table I provides information on the number of samples to take.

At the majority of LUST sites the focused approach to sampling described above may be used. However, at LUST sites where reliable indicators are absent, field observation and screening techniques are not useful in identifying where to sample. These sites are typically more complex and require an area-wide sampling approach.

FIGURE I

EXAMPLE OF SITE MAP

FIGURE IIII

RESULTS OF FIELD SCREENING AND CHEMICAL ANALYSIS SAMPLING OF THE EXCAVATIONS

Sample Number	Sample Location	Sample Depth	Date Sampled	Field Screening Results		Gasoline-range Hydrocarbons WTPH-G (mg/kg)	Volatile Aromatic Hyc EPA Method 8020		
				Headspace Vapors (ppm)	Sheen		B	T	I
Excavation Pit									
E-1	north wall	11.0	1/24/94	<100	SS	<5.5	<0.028	<0.028	<0.0
E-2	west wall	10.0'	1/24/94	<100	SS	<5.6	<0.029	<0.029	<0.0
E-3	south wall	11.0'	1/24/94	160	SS	18	<0.029	0.23	0.2(
E-4	east wall	10.0'	1/24/94	110	SS	<5.7	<0.028	<0.028	<0.0
E-5	base	12.0'	1/24/94	<100	SS	<5.5	<0.027	<0.027	<0.0
Continue summarizing all sample results from the walls and base of excavation pit as above.									
Product Lines									
P-1	base	3.0'	1/24/94	<100	SS	<5.8	<0.029	<0.029	<0.0
P-2	base	3.0'	1/24/94	<100	SS	<5.8	<0.029	<0.029	<0.0
P-3	base	3.0'	1/24/94	<100	SS	<5.7	<0.028	<0.028	<0.0
Continue summarizing all product line sample results as above.									
Service Island									
SI-1	base	6.0'	1/24/94	<100	SS	<5.9	<0.029	<0.029	<0.0
SI-2	base	6.0'	1/24/94	<100	SS	<5.7	<0.029	<0.029	<0.0
SI-3	base	6.0'	1/24/94	160	SS	<5.4	<0.027	<0.027	<0.0
Continue summarizing all service island sample results as above.									

FIGURE IIIIII

RESULTS OF FIELD SCREENING AND CHEMICAL ANALYSIS SAMPLING OF THE SOIL PILES

Sample Number	Date Sampled	Field Screening Results		Gasoline-range Hydrocarbons WTPH-G (mg/kg)	Volatile Aromatic Hydrocarbons EPA Method 8020 (mg/kg)		
		Headspace Vapors (ppm)	Sheen		B	T	E
SP-1	1/24/94	1200	MS	1000	0.10	8.5	16.(
SP-2	1/24/94	<100	SS	<5.7	<0.29	<0.29	<0.2
SP-3	1/24/94	<100	NS	<5.6	<0.28	<0.28	<0.2

Notes For Figure II and III

BTEX = benzene, toluene,ethylbenzene, totakylenes
ppm = parts per million
mg/kg = milligrams per kilogram
MS = moderate sheen
SS = slight sheen
NS = no sheen

Note to contractors:

Include laboratory reports in an appendix to your cleanup report.

Area-wide Sampling (The Statistical Approach)

Examples of sites that may require an area-wide sampling approach are sites where releases of product have occurred over a wide area (such as a tank farm) and sites at which product may have migrated for a long distance, making it difficult to be sure that all areas of contamination have been found and accurately mapped. At such sites the contractor should use either a random or systematic method for determining where to take samples.

A systematic approach can be described as follows. Using a map of the site, define the area of interest (that area where you believe contamination is most likely to have occurred), divide that area into smaller areas by placing an imaginary grid over it. Take a sample from each section of the grid and analyze.

Using a random approach, the contractor would define the area of interest and collect samples from locations (within that area) selected at random. Of these two methods, the systematic approach is preferred because it assures even coverage of the area.

If you use a sampling approach other than the focused approach, you must use the statistical methods described in the Statistical Guidance for Ecology Site Managers to determine cleanup levels. A statistical software package (MTCAStat) is available to assist with the calculations. To obtain these materials send your request to Department of Ecology, Toxics Cleanup Program, Policy and Technical Support Section, P.O. Box 47600, Olympia, WA 98504-7600. Requests for MTCAStat should include a formatted 3 1/2" disk.

Please Note: When selecting sampling locations, you should keep in mind that pathways for released product can also be created by sanitary and storm sewers, water lines, and other buried utility lines and utility trenches. These pathways allow released product, either liquid or vapor, to migrate in directions not anticipated by site soil characteristics or site hydrogeological conditions. Drywells, fill areas, basements, crawl spaces beneath residences and nearby wells are other possible migration paths for released product.

Excavated Soils

Table I provides guidance for the minimum number of samples to take from stock piled soils. Take samples at locations within the pile that are representative of the soils. Discrete grab samples should be collected with hand tools 6 to 12 inches beneath the surface of the pile. The location of each of these samples shall be where field instrument readings indicate contamination is most likely to be present. If field instruments do not indicate contamination, divide the pile into sections and sample each section.

TABLE I. NUMBER OF SAMPLES FOR EXCAVATED SOIL	
Cubic Yards of Soil	**Minimum Number of Samples**
0-100	3
101-500	5
501-1000	7
1001-200	10
>2000	10 + 1 for each additional 500 cubic yards

Field Instruments

The use of field instruments is recommended to help identify the location of contamination. Field instruments are also useful for monitoring potential exposures and determining health and safety precautions. A number of field instruments may be used for field screening purposes. These instruments include volatile gas meters with photoionization detectors (PIDs) and flame ionization detectors (FIDs), thin layer chromatography (TLC), portable gas chromatographs (GCs), calorimetric detector (Draeger tubes), and alkylation field chemistry kits (such as the "Hanby Field Test Kit").

PIDs and FIDs are useful for detecting and measuring released substances that have a volatile component (e.g. gasoline). PIDs and FIDs can measure groups of volatile organic vapors in soil (using a headspace technique) or in air. TLC offers the advantage of detection and semi-quantitative assessment of non-volatile petroleum residues. Portable Gcs and calorimetric indicator tubes can measure specific analytes (e.g. benzene). Although portable Gcs have a much greater potential sensitivity to low levels of contaminants than calorimetric tubes, they are more expensive and complex to operate.

Soil Sampling Techniques

Depending on site conditions, soil samples can be collected by one or more of the following sampling techniques:

* Hand auger/soil corer;
* Split spoon or shelby tube;
* Backhoe and hand tools; or
* Other approved techniques.

For more information about these sampling techniques see the Guidance for Site Checks and Site Assessment for Underground Storage Tanks, Section 5.2.2.

1.4.3 Groundwater Sampling

Groundwater sampling usually involves both water elevation measurements and the collection of samples for chemical analysis. If contaminated soils are found in contact with the groundwater or contaminated soils appear to extend below the lowest sampling point, the owner or operator must test for the presence of groundwater contamination. Installation of groundwater monitoring wells must be done by a licensed well driller. (See Chapter 173-160 WAC, Minimum Standards for Construction and Maintenance of Wells and Chapter 173-162 WAC, Rules and Regulations Governing the Regulation and Licensing of Well Contractors and Operators.)

One way to determine if water in an excavation pit is actually groundwater, is to: 1) sample the water to determine the appropriate disposal method, 2) pump the water from the excavation and properly dispose of it, and 3) wait 24 hours to see if water returns to the pit. If water returns to the pit (and it is not raining), it is probably from a groundwater source. You may sample and analyze this water and if it is below cleanup standards, you do not have to remediate it.

If groundwater is contaminated above cleanup standards , a minimum of three monitoring wells must be installed to characterize groundwater contamination and groundwater flow. A minimum of four wells is required if flow cannot be determined.

Groundwater monitoring should accompany any groundwater remediation. For example, if a pump and treat system is installed, water elevations should be taken and chemical samples should be collected to evaluate the treatment process. Final groundwater sampling is needed to ensure that groundwater cleanup standards have been met. See Table IV for method A cleanup standards for groundwater.

Ecology has developed a document on sampling and data analysis issues for Ecology staff to consider in reviewing independent cleanup reports. This document contains information on groundwater sampling and data analyses applicable to LUST sites. If you plan to submit a cleanup report to Ecology for review, you should obtain and read this document. To obtain a copy call Ecology Publications Distribution Office at (360) 407-7472 and request document number 94-49.

1.4.4 Analytical Methods

WAC 173-340-450(3)(iv) [see Appendix A] lists minimum testing requirements for LUST sites, based on whether leaded or unleaded gasoline, diesel, other petroleum products, or other hazardous substances may have been released. Table II provides analytical methods for the required analyses for petroleum UST releases. Table III lists additional analytical methods for waste oil contaminants which should be considered based on site history and the extent of contamination. If other hazardous substances have been released (e.g.EDB) samples should be analyzed for the hazardous substance and the most likely decomposition by-products of the substance.

Analysis of groundwater must be from unfiltered samples, unless it can be demonstrated that filtered samples provide a more representative measure of groundwater quality. WAC 173-340-720(8)(a) lists the conditions under which filtering is acceptable.

TABLE II. REQUIRED ANALYSES FOR PETROLEUM LUST SITES
EPA or Ecology Analytical Methods

SUBSTANCE	MEDIA	ANALYSIS	ANALYTICAL METHOD
If Type of Petroleum Contamination is Unknown	Soil	HCID	WTP-HCID
Gasoline-range Compounds	Soil Water Soil Water Soil Water	BTEX BTEX TPH TPH Total Lead Total Lead	8020 or 8260 8020 or 8260 WTPH-G WTPH-G 6010, 7420 or 7421[2] 7421[2]
Diesel-range Compounds	Soil Water	TPH TPH	WTPH-D WTPH-D
Petroleum Compounds Heavier than Diesel	Soil Water	TPH TPH	WTPH-418.1[3] WTPH-418.1[3]

A brief description of the analytical methods listed in Table II:

WTPH-HCID is a qualitative screen to determine the presence and type of petroleum products that exist at the excavation. This method should be used only if the type of petroleum contamination is unknown. It is intended to be a screen performed on contaminated soil that is representative of the contamination at the site. The results of this method will determine what quantitative method(s) is to be used in determining compliance with the matrix criteria. Should the result of the analysis for gasoline, diesel or heavy oils exceed the reporting limits, then the specific analytical method must be employed.

WTPH-G is the quantitative method for soils contaminated with gasoline that looks at the components toluene through dodecane. This methods adapts EPA SW-846 Methods 5030 and/or 8020 to perform the analysis for gasoline in soils.

[2]Not required if only unleaded gasoline is present.

[3]The WTPH-D can be extended to cover these hydrocarbons.

WTPH-D is the quantitative method for soils contaminated with petroleum products ranging from kerosene through fuel oil #2 (greater than dodecane through tetracosane). This method calculates all these products as diesel equivalents for use in the soil matrix. The method can be extended to include heavier oils with the use of the specific product calibration.

WTPH-418.1 is the quantitative method for soils contaminated with Bunker -C, lube oils or combination of TPH-D products and lube oils/Bunker-C. The method utilizes either the WTPH-D soil extraction or SW-846, Method 3540; however, both extraction methods require the use of Freon 113, rather than the listed solvent, in order to conduct infrared analysis.

Chromatographic identification methods (a ll methods in Table II except WTPH-418.1) are preferred to infrared absorption (the procedure used in WTPH-418.1) because absorption methods:

* are prone to false results (especially in the presence of other organics);
* do not provide any information regarding the individual hydrocarbons or their origin; and
* will have to change because freon, the solvent used in this method, will no longer be available.

For more detailed information on these analytical methods call (360) 407-7180 and request a copy of Total Petroleum Hydrocarbons Analytical Methods for Soil and Water.

TCLP

At sites where leaded gasoline or waste oil may be present and the contractor plans to dispose of the contaminated soil, excavated soil should be analyzed for total lead. If the soil total lead level is greater than 100 ppm, then the need for testing lead by the Toxicity Characteristic Leaching Procedure (TCLP) should be evaluated. TCLP is typically required by landfills to determine if the soil is acceptable.

Currently EPA does not require TCLP testing on contaminated soils and debris that are a result of tank removal activities. If it is possible the soil or debris might fail the TCLP for lead, the Hazardous Waste and Toxics Reductions Program office in the Ecology Regional Office should be contacted for current applicability, if any, of the TCLP rule.

TABLE III. RECOMMENDED ANALYSES FOR WASTE OIL SITES		
	EPA Analytical Methods	
Analyte	Soil	Water
TCLP[4]	1311	---
PCBs:	8080	8080
Total Metals (lead, chromium, copper, zinc):	6010 & 7000 series	6010 & 7000 series
Volatile Organics:	8021 or 8260	8021 or 8260
Phenols:	8040 or 8270	8040 or 8270
PAHs:	8100 or 8270	8100 or 8270

1.5 CLEANUP STANDARDS

1.5.1 Method A

Part VII of Chapter 173-340 WAC provides three methods for establishing cleanup standards for various hazardous waste sites. Method A is intended to provide cleanup standards for sites undergoing "routine" cleanup actions, such as sites with relatively few hazardous substances. There is a specific definition of a "routine" site in the Cleanup Regulation. See Table IV for Method A cleanup standards. For additional information on Method A see Chapter 173-340-704.

1.5.2 Method B

Method B is a risk-based method which evaluates several numbers that would protect against various exposures to hazardous substances. It is typically used on more complex sites. The most common numbers that are evaluated are: 1) numbers from other state and federal environmental laws, 2) specific formula values from the MTCA regulation to protect against direct contact with contamination, 3) levels to prevent migration from soil to water, and 4) natural background values.

Ecology has determined that Method A or the Method B soil-to-water value (from the LUST Matrix described below) is the appropriate soil cleanup level for most sites where TPH exists. However, under Method B, most of the values described above either do not exist or cannot be calculated because of current lack of information. Therefore, Method A numbers must be used for TPH or lead in soil.

[4] For excavated soil only. Analyze for lead if total is over 100 ppm.

The use of a site-specific risk assessment to establish cleanup levels for agricultural or recreational sites is allowed. For residential, commercial, or industrial sites; a site-specific risk assessment is difficult and should not be used to determine cleanup levels.

At most sites where TPH exists, cleanup standards should be determined by using the values listed in TABLE IV or by using Ecology's LUST matrix. The LUST matrix is described briefly below.

The Petroleum Contaminated Soils Rating Matrix (LUST Matrix)

The LUST matrix is a procedure that generates petroleum-contaminated soil cleanup levels (i.e., BTEX and TPH) that are protective of groundwater. Five site-specific parameters: groundwater depth, rainfall, soil type, receptor distance, and contaminated soil area are assessed in the matrix to derive soil cleanup levels that are protective of groundwater. Numerical point values have been assigned to each of the five site parameters. Sites that pose a high degree of risk to groundwater receive lower cleanup values. Conversely, higher levels of contaminated soil are allowed at those sites that pose a minimal threat to groundwater. Data from computer models and leaking underground storage tank sites in Washington were used to assign point values. The matrix may be applied to cleanup of those sites with petroleum contaminated soils. It cannot be used at all sites and should not be used for cleanup of shoreland sediments contaminated by petroleum releases to surface water. Use of the rating matrix satisfies the Method B site-specific demonstration of soil cleanup levels that are protective of groundwater (WAC 173-340-740(3)(ii)(A), (4)(b)(ii), and WAC 173-340-745(4)(a)(ii)(A) of the Model Toxics Control Act).

The rating matrix is but one procedure under Method B, and it only applies to BTEX and TPH. Other methods, such as soil leaching tests and modeling can be used to derive soil cleanup levels that are protective of groundwater. Predicting the ultimate fate of soil contaminants is a complex subject and Ecology recognizes that varied techniques may be used. For a copy of the LUST Matrix call Ecology's Publications Distribution office at (360) 407-7472 and request publication "ECY 020-71".

Total Petroleum Hydrocarbons (TPH)

TPH is a laboratory measurement of a broad range of individual organic chemical constituents with varying boiling points, carbon numbers, chemical families, and structural isomers. Method B allows for individual analysis of those constituents that comprise the total petroleum hydrocarbon spectrum. The measurement of TPH in soil is not to be used to circumvent compliance with individual hazardous substances such as BTEX. The measurement of total petroleum hydrocarbons in soil is intended as a "backup check on the degree of petroleum contamination" (p. 235, MTCA Responsiveness Summary, 1991). Thus, compliance with individual (i.e., BTEX) as well as total petroleum hydrocarbon (TPH) soil cleanup levels is expected.

TPH and Human Health Based Cleanup Levels

The threat to human health and the environment posed by complex chemical mixtures such as total petroleum hydrocarbons is being explored by the scientific community. Uncertainty exists as to correct reference doses (RFDs) and carcinogen potency factors (CPFs) for gasoline, diesel, and other complex chemical mixtures. Ecology has thus decided not to adopt currently available "interim" carcinogenic potency factors and reference dose values because of this uncertainty. In the interim, Ecology will be relying upon soil cleanup values in the Petroleum Contaminated Soils Rating Matrix as opposed to those generated by a risk assessment approach. Ecology will however continue to research this issue .

TABLE IV. METHOD A CLEANUP STANDARDS

	Cleanup Levels	
Hazardous Substance	Groundwater	Soil
Benzene	5 ppb	0.5 ppm
Ethylbenzene	30 ppb	20.0 ppm
Toluene	40 ppb	40.0 ppm
Xylenes	20 ppb	20.0 ppm
Total Petroleum Hydrocarbons (TPH): Gasoline TPH Diesel TPH Heavier than Diesel TPH	1,000 ppb --- --- ---	--- 100.0 ppm 200.0 ppm 200.0 ppm
Total Lead	5 ppb	250.0 ppm

1.5.3 Method C

Method C was established for certain "industrial sites". Again, there is a specific definition for what would qualify as "industrial". Under certain conditions when Method A or B cleanup standards are not technically possible, an owner or operator could conduct a site-specific risk assessment, establish cleanup standards by Method C, and provide institutional controls (WAC 173-340-440, 173-340-706, 173-340-720(4), and 173-340-740(4)).

1.6 PERMITS

The Model Toxics Control Act Cleanup Regulations do not impose any new permit requirements for site cleanups. However, excavations, soil treatment, and other activities related to LUST cleanups may require permits from local planning, building, health, or fire departments, as well as regional air pollution control authorities and the state. Ecology's Environmental

Review Section has prepared a guide entitled, "Permit Handbook," Publication Number 90-29 which provides more information on permits. To obtain a copy call (360) 407-7472.

Any necessary permits should be obtained prior to beginning site remediation, except during an emergency cleanup phase. An emergency phase is when the primary concerns are for alleviating immediate danger to public health, safety, or the environment, and for stabilizing the release or threatened release.

Time to process permits varies from days to months depending on the type of p ermit, local government procedures, and complexity of the site. Permitting or zoning requirements may not allow for soil treatment at some locations. The following is a summary of some of the permits or requirements which may be applicable to LUST sites:

1.6.1 State Environmental Policy Act (SEPA

Whenever owners or operators are conducting a cleanup which requires permits or other local or state agency written approvals, the proposal may need to go through the SEPA process. If a significant adverse environmental impact is anticipated during the cleanup, an environmental impact statement (EIS) may be required (see Chapter 43.21C RCW and Chapter 197-11 WAC). Contact the agency providing the permit or written approval for specific requirements.

1.6.2 Air

Air regulations are enforced by, and under the authority of, either local air agencies or the Department of Ecology, depending on the location of the emission source in the state. See Appendix D for the appropriate agency for each county. The treatment of some contaminated soils or water is a regulated activity due to the potential emissions of hydrocarbons as volatile organic compounds. Owners or operators of LUST sites shall contact these offices for possible Notice of Construction permits and/or actions necessary to meet other air requirements. See Chapters 43.21A and 70.94 RCW, and Chapters 173-400 and 173-460 WAC, for the statutory requirements. Applications or inquiries should be made several months prior to the intended operations, if possible, to allow time for review and any needed follow up for approval.

1.6.3 Solid Waste

Under the Minimum Functional Standards (MFS), the state's solid waste regulation, petroleum contaminated soils which are not dangerous wastes are called "problem wastes" (Chapter 173-304 WAC). The MFS does not yet have specific treatment or disposal standards for problem wastes. Under state solid waste law, county health departments are responsible for any necessary solid waste permitting for petroleum contaminated soils. This guidance will serve as Ecology's recommendations for permitting and other PCS issues.

Ecology's policy is that PCS which contains contaminants above the Model Toxics Control Act Method A cleanup standards is to be regulated as solid waste. Specific items in the policy include:

1) The local health department should be notified of on-site treatment Additional information is in Subsection 2.3.1.
2) The local health department must be notified if any PCS is to be transported into or within their area for treatment at a temporary treatment facility. Additional information is in Subsection 2.3.1.
3) The local health department must permit regional treatment centers.
4) If Class 3 soils (defined in Section 3.0) from more than one site are placed in a single location, that location should be permitted as a new solid waste disposal facility.
5) Class 4 soils (defined in Section 3.0) must be disposed of in a permitted solid waste facility (existing facility or a newly permitted PCS landfill) or treated.

1.6.4 Dangerous Waste

When the soil is highly contaminated, the owner or operator will need to determine whether or not the soil is a dangerous waste. Generation, treatment, transportation, and disposal of dangerous wastes are subject to the state dangerous waste regulations, Chapter 173-303 WAC. Dangerous wastes can be transported only to specifically permitted facilities for treatment, storage, or disposal.

It is possible that lead, benzene, polynuclear aromatic hydrocarbons, or contaminants such as polychlorinated biphenyls could trigger dangerous waste designation. Soils contaminated by releases from regulated underground storage tanks have been exempted from the requirement to use the Toxicity Characteristics Leaching Procedure (TCLP). **Contents of tanks are not exempt from this testing prior to disposal.**

1.6.5 Water Quality Permits

There are four options for discharge of contaminated water from cleanup sites: 1) discharge to surface water, 2) discharge to sanitary sewer, 3) discharge to ground and groundwater, and 4) transport to a permitted, industrial waste water treatment facility. Water quality permitting may be required at LUST cleanups. Most of these permits are issued by Ecology's regional offices and will require an annual fee payment by the discharger (Chapter 173-223 WAC). Regional Office Water Quality staff should be contacted early in the project planning phase to allow sufficient time for review. See Appendix F for locations and phone numbers of regional offices.

1) Surface Water Discharge

If contaminated groundwater will be discharged from a point source to state surface waters (including storm drains), the owner or operator will need to obtain a National Pollutant Discharge Elimination System permit (regulated under Chapter 173-220 WAC). Applications are available from regional offices and should be submitted in an acceptable fashion no later than 180 days prior to the planned commencement of discharge. Unfortunately, current permitting workloads are such that 180 days will unlikely be adequate time to prepare an NPDES permit. No discharge will be allowed prior to issuance of a permit. Rules governing these types of discharges require monitoring and reporting of effluent quality and providing treatment for wastewater. Contact the appropriate Ecology Regional Office Water Quality staff for permitting requirements and application forms.

2) Sanitary Sewer Discharge

A discharge permit is required if wastewater is discharged to a municipal sewer system (Chapter 173-216 WAC). These permits are called pretreatment permits when issued by local entities which have delegated pretreatment programs. METRO (Seattle area), Tacoma, Spokane, Richland, Vancouver are delegated programs that write permits for discharge to their own sewage system. Permits called State Waste Discharge Permits for Industrial Users are issued by Ecology regional staff for discharges to other publicly owned wastewater treatment plants. Time frames and application and permit requirements vary depending on the situation and the receiving wastewater treatment plant. Some wastewater treatment plants are discouraging discharges to the plant from groundwater cleanups due to hydraulic overloading and lack of additional treatment at the plant. Contact the appropriate local entity and the Ecology Regional Office Water Quality staff for permitting requirements and application forms.

Complete and accurate applications for Ecology's State Waste Discharge permits must be submitted to the appropriate regional office no later than 60 days prior to discharge. Ecology will determine if a permit is necessary, based on the specific activity and effluent quality. Rules governing these discharges may require monitoring the effluent, reporting the effluent quality and providing treatment for the wastewater prior to discharge.

3) Ecology has determined that reinfiltration galleries are an acceptable method of treated water discharge during site remediation where feasible. The discharger must demonstrate that the water discharged is hydraulically contained on the site until the cleanup action is completed and groundwater meets the cleanup standards.

Discharges to groundwater whether contained on-site or released off-site may require State Waste Discharge Permits, which are issued by Ecology's regional offices. Local conditions and the method of discharge and containment will determine the need for the permit. Complete and accurate applications must be submitted at least 60 days prior to discharge. Contact the appropriate regional office Water Quality staff for application forms and information.

4) The fourth option for disposal of contaminated pump water, purge water, or extracted groundwater is storage and transport to a facility permitted to receive industrial wastewaters. For water which designates as Dangerous Waste; a permitted, hazardous waste treatment facility must be used. Contact the appropriate facility for further information. Information can often be found in the Yellow Pages under "Waste Disposal-Hazardous."

1.6.6 Laboratory Analyses

Ecology requires that water analyses be performed by laboratories that are accredited by Ecology (Chapter 173-50 WAC and WAC 173-340-830). At this time, there is no accreditation program for soils analyses. Call Ecology's Quality Assurance/Quality Control Section at (206) 895-4649 for a current list of laboratories accredited for water analyses.

1.6.7 Shoreline Management

If excavation or construction at a LUST site is within 200 feet of a water body over 20 acres (including associated wetlands) or within the floodplain of a river or certain streams, a Shoreline permit may be required (see Chapter 90.58 RCW, Chapters 173-14 through 173-28 WAC, and local master plans). Owners or operators must apply for the permit from the local jurisdiction, usually the county or city planning or building department. If soils on or near the site are saturated with water at least part of the year, the owner or operator should talk to the local jurisdiction. The site may be on a wetland, and may be regulated by local ordinances.

1.6.8 Water Resources

Resource protection wells, as defined under Chapter 18.104 RCW, and product recovery wells, including vapor extraction installations and sometimes including soil gas sampling installations are regulated under Chapter 173-160 WAC. They must be constructed in accordance with the provisions of Chapter 18.104 RCW.

If more than 5000 gallons per day of groundwater will be withdrawn for treatment and discharged off-site or to a sewer system, the owner or operator must contact Ecology's regional Water Resources Section to find out if a water right permit will be required. In general, pump and treat options do not require a water right permit if the treated water is completely returned to the environment without disrupting existing water rights.

1.6.9 Washington Industrial Safety and Health Act

For most locations in Washington, employers are required to comply with the workplace safety and health regulations given in Chapter 296-155 WAC (Safety Standards for Construction Work), Chapter 296-62 WAC (General Occupational Health Standards), and Chapter 296-24 WAC (General Safety and Health Standards). Enforcement is through the Washington Department of Labor and Industries, Division of Industrial Safety and Health (WISHA). See Appendix B for WISHA phone number. On certain federal properties, and on navigable waters, the corresponding federal regulations, 29 CFR 1910 and 29 CFR 1926 apply, with enforcement through the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA).

The employer should review the full standards to assure that all operations, company policies, work methods, hazard control measures, employee training, personal protective equipment, and other aspects of work being performed are in compliance. Two sections of the WISHA Code are of particular relevance to petroleum contamination remediation: Hazardous Waste Operations and Emergency Response (HAZWOPER, Part P of Chapter 296-62 WAC), and Excavation, Trenching and Shoring (Part N of Chapter 296-24 WAC).

Among the major HAZWOPER requirements are site safety plans, site characterization, monitoring and employee training. Training requirements vary from 24 to 40 or 80 hours, depending on the degree of hazard and type of activity to which workers are exposed. Appendix B provides Labor and Industries' phone numbers and address and who to call with questions on health and safety issues. The trenching, shoring and excavation standard requires sloping and/or shoring for protection during excavation. Protection systems for excavations more than 20 feet in depth are to be designed by a registered professional engineer.

Assistance and copies of WISHA regulations are available from the Labor and Industries' regional field service locations listed in Appendix B, or by calling 1-800-423-7233. For information on OSHA standards, call (206) 442-5930.

2.0 TREATMENT OF PETROLEUM CONTAMINATED SOILS AND GROUNDWATER: TEMPORARY TREATMENT SITES

2.1 INTRODUCTION

This section provides guidance for sites where treatment of petroleum contaminated soil (PCS) is expected to occur only once. Gas stations treating soils from a spill or leak are the most common example of this type of treatment facility. Treatment may occur on-site or at another location. **NOTE:** For a list of permanent regional treatment facilities that treat PCS see Appendix H. To obtain information on how to establish a permitted regional treatment facility talk to your jurisdictional health department.

Only the most widely used technologies are discussed here. Specific recommendations are given in this section for the following technologies:

1) Soil bioremediation;
2) Soil venting;
3) Air Sparging;
4) Aeration;
5) Thermal desorption;
6) Land-filling; and
7) Pump-and-treat for groundwater.

Minimum controls that are discussed in this section include: 1) "general requirements" for all sites and technologies; and 2) "technology specific requirements" based on each treatment technology.

General requirements for all sites:

- Notification and reporting;
- Health and safety;
- Untreated waste characterization;
- Containment and storage of contaminated soil/water ;
- Monitoring;
- Maintenance;
- Treated waste characterization; and
- Transportation of material to another site.

Technology specific requirements:

- Vary with each technology, e.g., permitting requirements.

2.2 POLICY

Ecology's Toxics Cleanup and Hazardous Waste and Toxics Reduction Programs encourage on-site treatment where the actions themselves will not cause a threat to human health or the environment (e.g., release of heavy petroleum fumes, contaminated run-off, or airborne contaminated soil). The Model Toxics Control Act (MTCA) requires that preference be given to permanent solutions for the site cleanup. The regulation established under this law further specifies a hierarchy for selecting treatment technologies (WAC 173-340-360). The list is below, beginning with the preferred category:

1) Reuse or recycling;
2) Destruction or detoxification;
3) Separation or volume reduction, followed by reuse, recycling, destruction, or detoxification;
4) Immobilization;
5) On-site or off-site disposal at an engineered facility;
6) Isolation or containment; and
7) Institutional controls and monitoring.

This hierarchy should be used to select appropriate treatment technologies. For example, technologies such as bioremediation (if destruction of contaminants occurs) is preferable to aeration or landfilling. Thermal desorption, followed by incineration of off-gases (if destruction of contaminants occurs during incineration) is preferable to thermal desorption alone.

2.3 GENERAL REQUIREMENTS

The following requirements apply to all temporary treatment sites.

2.3.1 Notification and Reporting

Air Authorities

Notification and reporting shall be made to air authorities per Subsection 1.6.

Ecology's Regional Offices

Under the MTCA, Ecology's notification and reporting requirements for treatment at leaking underground storage tank sites are outlined in WAC 173-340-450. Requirements include: 1) notifying of intent to begin cleanup (this can be included with other reports required under WAC 173-340-450), and 2) submitting a final report. See Subsection 1.3 for more detail on these reporting requirements.

Local Health Departments

Ecology recommends that anyone who wants to operate an on-site temporary treatment facility should provide prior, written notification to the local health department (Ecology does not recommend solid waste permits for these on-site temporary treatment facilities). An example notification form (Appendix E) lists the minimum information which Ecology recommends providing to the health department. Contact each health department for specific requirements in that county.

Persons proposing to transport to or operate an offsite temporary treatment facility must notify the jurisdictional health department. The health department may require a solid waste permit for this activity. Other transportation requirements (e.g., no spilling or littering, covering loads) are discussed in Subsection 2.3.8.

The Public

The public should be protected and informed. When there is a physical or chemical th reat to the public, remedial sites should be secured by sturdy fencing or other means to prevent access. Ecology recommends that simple signs be posted at the site which describe the remedial action and provide a contact where the public can obtain further information.

2.3.2 Health and Safety

The major health and safety requirements for temporary treatment facilities are site safety plans, site monitoring and employee training. For information on health and safety regulations call 1-800-423-7233 and refer to Chapter 296-155 WAC (Safety Standards for Construction Work), Chapter 296-62 WAC (General Occupational Health Standards) and Chapter 296-24 WAC (General Safety and Health Standards).

A site safety plan addressing important chemical and physical hazards must be prepared and used. Preparation is the most important factor in preventing mishaps during facility operations. Each worker at the temporary treatment facility should be given a copy of the site safety plan and informed of specific hazards. Refer to Chapter 296-62 WAC for the specific items that must be included in a site safety plan.

Any handling of gasoline-contaminated soils will result in volatilization of light fractions of petroleum. These organic vapors must be monitored to determine the level of personal protective equipment (PPE) that must be worn. Chapter 296-62 WAC describes four levels of PPE: A ,B,C and D. Level A PPE must be worn to provide protection for very hazardous situations and Level D is designed to provide protection for low-hazard situations.

Health and safety training requirements vary depending on the degree of hazard and type of activity. Facility personnel whose activities require them to wear Level A or B PPE are required to have at least 80 hours of health and safety training. Facility personnel who are only

required to wear Level C or D PPE must have at least 40 hours of training. Supervisory personnel are required to have 8 hours of additional training. Refresher training is required annually.

2.3.3 Untreated Waste Characterization

Prior to treatment, all petroleum contaminated soils and contaminated groundwater should be characterized according to Subsection 1.4 of this document. The goal of this sampling is to provide information on type and concentration of contaminants for purposes of treatment and disposal. Representative sampling should be used to determine the approximate minimum, maximum and average concentrations of petroleum product(s).

2.3.4 Containment and Storage of Contaminated Soils

Short-term Containment and Storage

This applies to materials being held for 60 days or less. Material may be stored on-site prior to receipt of lab results and subsequent treatment and disposal. However, all soil and water should be contained by drums, liners/covers, tanks, etc. until treatment begins. This includes purge and pump test water from wells and soil boring cuttings as well as larger amounts of excavated material. For synthetic liners or covers used over a short time period, 10 mil visqueen or equivalent should be adequate if it is properly maintained. Containment should be checked and maintained during storage to ensure that there are no releases to the environment.

Long-term Containment or Storage

This applies to soils which are being held for longer than 60 days (e.g. during treatment or storage prior to treatment). The goal of containment is to prevent further releases to the environment. A liner system should consist of a bermed installation which is floored with an impervious surface such as cement, asphalt (use only for slightly contaminated soils), synthetic liner (compatible with hydrocarbons) or native clay. In all cases, the liner should be designed to handle loadings of soil and any equipment which will be used to place the soil. It should also be designed to contain the type and concentrations of contaminants that will be placed on it.

Each type of liner requires specific considerations. For cement and asphalt, any cracks which could allow leakage should be sealed. Asphalt is not appropriate for heavily contaminated soils (those containing free liquids) or other situations where the asphalt will disintegrate. For synthetic liners, 30 mil reinforced or equivalent should be used. Synthetic liners should be covered with a protective layer of soil/sand that will not be disturbed during the treatment process. For native materials, scarify and recompact on-site soils (if suitable) or import suitable clay to provide a liner. A compacted 6" lift (permeability less than 10^{-6} cm/sec) should be suitable for light or moderate contamination. Adjust the thickness as appropriate for the situation. In areas where rainfall is high and depth to groundwater is typically shallow (e.g., western Washington), in situ native soils should not be relied upon to protect groundwater .

Berms should be constructed around soils to prevent runoff of free liquids. They can be straw bales, mounded sand, concrete or any material which will form a barrier for contaminants or run-off. These berms should be covered with a synthetic liner if there is any chance of leachate migration through the berms. Long, narrow containment beds are recommended over short, wide beds. The long beds are typically easier to cover and maintain.

The containment bed should be covered, if necessary, to: 1) minimize releases to the environment (e.g., contaminated run-off, airborne soils, hydrocarbon fumes), 2) maintain optimum moisture levels (e.g., bioremediation), or 3) prevent excess soil moisture (e.g. bioremediation or thermal desorption). Visqueen or synthetic cover, organic mulch, shed-type roof or enclosed structure may be used provided they accomplish the objective of appropriate containment. For example, organic mulch can prevent airborne soils during aeration, but is not appropriate for containment of volatile organic vapors. Also, an enclosed structure without ventilation would not be appropriate where high levels of fumes could reach the Lower Explosive Limit (LEL) and cause an explosion or fire.

When containment could extend into the rainy season, a leachate control system or cover should be installed. At a minimum, the leachate control system should consist of site grading which directs runoff to a collection sump. Run-off can then be pumped and reapplied to the pile. Runoff controls should be checked (particularly during and after storm events) to ensure they are operating properly. Any excess leachate needs to be characterized and disposed of in accordance with all applicable local, state and federal laws. See Subsection 1.6.5 on water quality permits. Excess water in the soil may interfere with any treatment process. The storage of solid waste is regulated by local health jurisdictions.

2.3.5 Monitoring

The vertical and horizontal extent of contamination should be completely defined. If this was not done during initial characterization (e.g., soil sampling and other requirements as noted in Guidance for Site Checks and Site Assessments for Underground Storage Tanks), more sampling is needed. Monitoring for this purpose may include: additional soil borings, groundwater monitoring wells, soil gas sampling, etc. Sampling locations should be selected on a site-by-site basis.

Monitoring should also be conducted during treatment. The goal of this sampling is to evaluate progress of treatment, check for releases of contaminants (e.g., air monitoring, soil, and groundwater sampling as needed) and determine if cleanup standards have been met.

2.3.6 Maintenance

Frequent, regular checks should be made on the area to ensure that no further releases occur and that all equipment and containment systems are operating properly. In particular, checks should be made immediately before, during and after high winds or heavy rainfall. One person should be assigned the responsibility for ensuring that these checks are made and keeping a log of these activities. Many storage or treatment systems are well designed and installed, but poorly operated. Operation and maintenance are as important to the effectiveness of the treatment as the design.

2.3.7 Treated Soil and Water Characterization

After treatment, all PCS and groundwater should be characterized using the analytical methods in Subsection 1.4 to determine compliance with the cleanup standards. This determines if treatment is complete and what the final disposition of the material can be. Interim monitoring may also be done to check the progress of the treatment and allow for any necessary changes.

2.3.8 Transportation of Contaminated Material

Transportation of contaminated soil or water to another location for treatment may occur for the following reasons: (1) material could cause a threat to human health or the environment if treated on-site; (2) treatability studies will be conducted at another location; (3) material is being transported to a landfill or regional treatment facility; or (4) it is more convenient to treat the material at another site. It is critical that no further release to the environment occurs during transport and subsequent treatment.

For soils, the requirements in WAC 173-304-200(3) (collection and transportation standards for solid waste) apply. Appendix G (WAC 173-304-200 On-site containerized storage, collection, and transportation standards for solid waste) gives details on collection and transportation standards, such as no littering or spilling material, covering trucks, and inspecting and cleaning equipment. The local health department should be notified. See Subsection 2.3.1 (reporting requirements) and Appendix E (example notification form).

2.4 TECHNOLOGY SPECIFIC REQUIREMENTS

This section is not meant to be a comprehensive description of all soil and groundwater treatment methods. Technology is moving forward rapidly in the remediation area, and Ecology encourages new and innovative remediation methods coupled with adequate monitoring to validate remediation progress.

For general requirements that apply to all temporary treatment sites see Subsection 2.3.

2.4.1 Soil Bioremediation

Bioremediation involves addition of oxygen and nutrients in a controlled setting. This is typically done by excavating soil and placing it in mounds or small lifts. Airflow (oxygen supply) through the soil is accomplished with perforated pipes (more appropriate for gasoline contamination) or tilling (appropriate for diesel or heavier petroleum contamination). This should not be confused with aeration which simply allows evaporation of contaminants into the air. Any tilling of soils containing gasoline or other volatile compounds is more aeration than it is bioremediation. "Land-farming" or "composting" is a combination of both aeration and bioremediation. As described in Subsection 2.2, technologies (such as bioremediation) which provide actual destruction or detoxification of contaminants are preferred to those which do not provide this type of treatment (WAC 173-340-360).

Nutrient Addition

Appropriate nutrient application rates must be determined based on waste type, waste concentration and soil characteristics. Nitrogen and phosphorus, two nutrients essential to a successful bioremediation process, are not found to occur naturally in adequate concentrations. A source of oxygen must also be provided through tilling or an air blower with perforated piping. Tilling, while providing an oxygen source, will volatilize substantial portions of gasoline. This practice is not a preferred alternative, particularly in areas where vapors could adversely affect humans or animals (next to residences, restaurants, pedestrian areas). For these situations, an oxygen source should be provided by air blower. Thorough mixing of contaminated soil, nutrients, water and microbes is critical to the process, but must be balanced by health and safety considerations involving air emissions.

Schedule

Treatment times will vary according to seasonal conditions, type and concentration of contaminant, soil type, and treatment configuration chosen. However, operations at a one-time treatment facility should not continue indefinitely, and a good-faith effort should be undertaken to complete the cleanup in as timely a manner as possible. Most sites can be remediated within six to nine months.

Permits

Permits which might be necessary for this technology include: health department permits, air permits, local fill and grading permits and water discharge permits. See Subsection 1.6 for details on various permits.

2.4.2 Soil Vapor Extraction (Soil Venting

This technology involves installing vertical or horizontal piping in the area of soil contamination. An air "blower" is then used to draw vapors out of the ground. The technology is appropriate for volatile contaminants only (e.g., much of gasoline contamination can be treated using this technology, but it is not effective for diesel). Soil may be excavated and placed in

mounds or back in the pit. In situ soil vapor extraction involves only the installation of pipes in the contaminated area. No excavation is done. Under the technology hierarchy in WAC 173-340-360, venting with subsequent air treatment is preferable to venting and direct discharge into the atmosphere.

Soil venting should be used for volatile compounds only in areas where the soil permeability allows easy vapor movement. The amount of soil organic matter and soil moisture will also affect the ease of stripping volatiles. Because contaminants move more readily through soils where the moisture has been evaporated and venting must be done simply to remove this moisture, soil moisture is an important parameter to evaluate in the design of these systems. Soil venting has little impact on the removal of soil contaminants from below the water table. Dewatering is generally required to allow effective venting of saturated soil.

Well Placement

Piping, size, spacing and placement should be based on a knowledge of the subsurface conditions. Extraction wells should be placed as close as possible to the most heavily contaminated areas. Spacing must be close enough to minimize the distance which contaminants must travel and allow for adequate vacuum through the volume to be treated. Modeling may be useful for this determination. Vertical wells should be placed with the groundwater table (possibly fluctuating) in mind. Wells too close to groundwater draw up water and interfere with equipment. Wells too far from the water table may not be effective in removing contaminants that have been "smeared" in the vadose zone by a rising and falling water table. The air blowers should be sized for the site conditions.

Nuisance Fumes or Noise

Location of the exhaust stack and blower equipment should consider proximity of workers at an active facility and the public (e.g., place equipment as far as possible from traffic, office space, sidewalks, or homes).

Permits

Contact the local air authority (Appendix D) to determine if an air permit is required.

2.4.3 Air Sparging

Air Sparging involves installing a system which will inject clean air below the groundwater table. Air then flows upward through the groundwater carrying volatile contaminants into the unsaturated zone above the water table. This technology is used in conjunction with a soil venting system which will collect and remove those volatile compounds from the unsaturated zone. Air flow should be through the most contaminated volume of soil. Under the technology hierarchy in WAC 173-340-360, air sparging/soil venting with subsequent air treatment is preferable to using this technology without air treatment and, thus, venting contaminated air directly into the atmosphere.

This technology is relatively new and its implementation is currently a trial-and-error process. It has been useful at some sites and not effective at others. Design should take into consideration the type of contaminant, the geology of the site, and the treatment system itself (e.g., injection air flow, extraction air flow, air pressure, placement of well screens and, number of wells).

EPA has published a report on air sparging. The document can be ordered from the National Technical Information Service at (703) 487-4650. The document order number is PB93-100154/AS and the cost is $19.00.

2.4.4 Aeration

This solution for treatment of PCS evaporates volatile components of petroleum from the soil into the air. Soil is spread in thin lifts and tilled or turned to increase the rate of evaporation. This treatment method should not be used in urban areas or other locations where organic vapors could cause health, fire, or nuisance hazards. According to the regulation for the MTCA, aeration is lower on the treatment hierarchy than technologies which provide destruction of contaminants (WAC 173-340-360). Check with local air authority before planning to use aeration.

Permits

Contact the local air authority (Appendix D) to determine if a permit is required. Local fill and grade permits may also be needed.

2.4.5 Thermal Desorption

This technology heats soil to 300- 700°F which results in evaporation of some hydrocarbons. Organics in these gases can then be destroyed by incineration (approximately 1500 degrees F). Other hydrocarbons will remain in the soil depending on : 1) soil temperature; 2) soil moisture content; 3) soil texture; 4) residence time in the treatment unit; 5) contaminant type; and 6) contaminant concentration. According to the regulation for the MTCA, this type of contaminant destruction is preferable to thermal desorption alone (Chapter 173 -340-360).

Monitoring

In addition to sampling described in the general requirements, off -gases should be monitored to allow determination of the amount of hydrocarbons going out the stack versus the amount actually being destroyed.

Permits

Permits that might be necessary include: 1) air permit; 2) local fill and grading permits; and 3) water discharge permits. See Subsection 1.6 for details.

2.4.6 Landfilling

This solution for wastes is the least preferred according to the regulations for the Model Toxics Control Act and the Solid Waste Management Law. It should be used only when other solutions are not available. Some landfills in eastern Washington accept petroleum-contaminated soils for treatment prior to use as fill or cover in the landfill. This should not be confused with facilities accepting material simply for disposal.

Permits

Many landfills will accept only waste from the same county and have requirements for waste characterization and maximum contaminant concentrations. Contact individual facilities and the local health department for requirements and limitations.

In general, Ecology recommends that lined, municipal landfills be used for disposal of untreated PCS. However, some areas of the state do not have lined facilities available and disposal at an unlined facility may be the only local option. At a minimum, landfills should be in compliance with Chapter 173-304 WAC, the Minimum Functional Standards, and operated to prevent releases to ground or surface water.

2.4.7 Groundwater Pump and Treat

This technology is used when groundwater beneath a site h as become contaminated with petroleum. Contamination may be in the form of free product floating on the water table or petroleum constituents dissolved in the water. Any free product which exists should be removed as soon as possible. This type of contamination is the most concentrated and is the easiest and least expensive form (per unit of contaminant) of groundwater remediation. Free product should be recycled if possible.

For dissolved phase contamination, groundwater is extracted, treated and dis posed of. Several types of treatment could be used depending on the type/concentration of contaminant and the site conditions. Some of the possible treatment technologies include oil/water separators, air strippers, activated carbon, and bioremediation.

Disposal options for extracted groundwater include : 1) to surface water; 2) to groundwater (e.g., reinjection); 3) to a sewerage system; and 4) to an industrial wastewater treatment facility. See Subsection 1.6 for information on water quality permits.

Any cleanups using in-situ bioremediation or other remediation requiring the injection of compounds into the groundwater must contact Ecology's regional offices (Appendix F) concerning permitting requirements. Ecology may allow the use of this technology in certain applications, such as underneath existing structures, other areas where excavation is difficult, or where such injection is necessary to provide effective treatment. For in-situ technologies, performance monitoring and obtaining uniform treatment are difficult. In-situ treatment is recommended only when other methods are not feasible.

Treatment

All extracted groundwater which does not meet Method A compliance cleanup standards should receive treatment either on-site or by a wastewater facility.

Permits

See Subsection 1.6.5 for information on water quality permits (discharge to surface water, groundwater, etc.). Air permits may be needed for air strippers.

3.0 END USES OF SOIL

This section discusses classification of petroleum contaminated soils based on contaminant concentrations and their appropriate end uses. The classifications 1 through 4 may be used for both treated and untreated soils. Ecology recommends treatment for all untreated Class 3 and 4 soils.

3.1 POLICY STATEMENT

Under the rules for the Solid Waste Management law (RCW 70.95) and the Model Toxics Control Act (RCW 70.105D), highest priority is given to recycling, reuse, and permanent solutions for management of waste (rather than landfill disposal). The Toxics Cleanup Program (TCP) and the Solid Waste Services Program are therefore promoting the treatment and reuse of petroleum contaminated soils, consistent with the cleanup standards and selection of remedy in Chapter 173-340 WAC.

3.2 CLEANUP STANDARDS

For most PCS sites, Method A under the MTCA regulation should be used to determine the petroleum cleanup levels. These standards are listed in Table IV of this document. Other methods for determining cleanup standards require evaluation of site-specific conditions and are typically used for more complex sites. In addition, soils with contaminants other than petroleum must also meet the cleanup standards for those constituents (e.g., waste oil contamination where metals, PCBs or solvents exist) or be taken to appropriate disposal facilities.

3.3 END USE CLASSIFICATION and DISPOSAL

Class 1 Soils

Treated or untreated soils which contain residual concentrations of contaminants at or below analytical reporting limits may be used where they would not cause a threat to human health or the environment. Ecology designates these soils as "Class 1" (less than Practical Quantification Limits [PQL]). See Table V, "End Use Criteria For Petroleum-Contaminated Soils," for specific contaminant concentrations.

Examples of appropriate uses for these soils include: fill underneath pavements; fill at industrial or commercial facilities; backfill at the cleanup site; and cover at landfills or any other uses which would not cause threat to human health or the environment.

Class 2 Soils

Treated or untreated soils which contain detectable levels of petroleum contaminants below the MTCA Method A cleanup standards are designated by Ecology as "Class 2" soils. Appropriate uses include; backfill at the site, industrial or commercial fill, cover or fill in permitted landfills, road or parking lot construction, or other uses which will not cause a threat to human health or the environment. While these soils are below the cleanup standards ; Ecology recommends that they not be used in or adjacent to wetlands, surface water, groundwater, drinking water wells or utility trenches. Ecology also recommends that they not be used as residential topsoil.

Class 3 Soils

Ecology strongly recommends treatment for all Class 3 soils which have not yet been treated. However, Ecology recognizes that soils with high levels of heavy hydrocarbons may not be able to meet cleanup standards even after treatment. Soils with residual heavy hydrocarbons greater than the MTCA cleanup standards are designated "Class 3" soils. However, even for these soils, benzene, toluene, ethylbenzene and xylene must be below the cleanup standards since soils receiving adequate treatment should be able to meet the cleanup levels for light petroleum fractions. If soils are treated but cannot attain cleanup standards, they should be: 1) disposed of at the original site; 2) used as subgrade material in road or parking lot construction; 3) used or disposed of in an existing permitted municipal landfill; or 4) disposed of in a new permitted PCS landfill.

In general these are appropriate places for these materials, however they should not be placed in areas which may cause further release to the environment or may cause human health problems. Items to consider in this evaluation include:

- Surrounding land use;
- Depth to groundwater;
- Type and concentration of contamination;
- Volume and configuration of soil to be placed; and
- Any other factors which will contribute to the probability of a release which would threaten human health or the environment.

Class 4 Soils

Ecology strongly recommends treatment for all soils with residual petroleum contamination greater than "Class 3" which have not yet been treated. These soils should then be disposed of in an existing permitted municipal landfill or in a new permitted PCS landfill. The goal of treatment should be to meet the cleanup standards.

TABLE V. END USE CRITERIA FOR PETROLEUM-CONTAMINATED SOILS

Analyte	Analytical Method	Soil Class (ppm) 1	2	3	4
Heavy fuel hydrocarbons (C24-C30)	WTPH-418.1 mod.	<60	60-200	200-2000	>2000
Diesel (C12-C24)	WTPH-D	<25	25-200	200-500	>500
Gasoline (C6-C12)	WTPH-G	<5	5-100	100-250	>250
Benzene	8020	<0.005	0.005-0.5	≤0.5	>0.5
Ethylbenzene	8020	<0.005	0.005-20	≤20	>20
Toluene	8020	<0.005	0.005-40	≤40	>40
Xylenes (total)	8020	<0.005	0.005-20	≤20	>20

Treatment is strongly recommended prior to disposal for all Class 3 and 4 soils.

NOTES:

Class 1 Soil Uses: Any use which will not cause threat to human health or the environment.

Class 2 Soil Uses: Backfill at the original site
Fill in commercial or industrial areas
Cover or fill in permitted landfills
Road or parking lot construction material
Fill in or near: wetlands, surface water, groundwater, drinking water wells or utility trenches is NOT recommended. Use as residential topsoil is also NOT recommended.

Class 3 Soil Uses: Treatment
Disposal at the original site (no solid waste disposal permit needed) **note:** If you use this option, there will still be hazardous substances above the cleanup levels on site.
Road or parking lot construction (subgrade material only)
Offsite disposal or use in an existing permitted municipal landfill
Offsite disposal at a new permitted PCS landfill
(An evaluation should be made to ensure that disposal will not cause a threat to human health or the environment, e.g., use near water bodies)

Class 4 Soil Uses: Treatment
Offsite disposal in an existing permitted municipal landfill
Offsite disposal at a new permitted PCS landfill

3.4 RECORDKEEPING

Detailed records should be kept on treatment and disposal/placement of all PCS. Because the MTCA assigns liability to owners and operators of properties/facilities, these records are necessary to provide information concerning the treatment and final disposition of these soils. Items 1-8 should be documented prior to treatment. Items 9-10 are documented after treatment and disposal.

Specific items that should be documented include:

1. Origin owner and address of contaminated soil ;
2. Owner name, address and phone number ;
3. Engineering consultant name, project manager, address and phone;
4. Type of facility (e.g., gas station, spill);
5. Total volume of contaminated soil ;
6. Type(s) and concentration of contaminant originally in soil (include analytical results from lab);
7. Name, address and contact name of firm providing treatment;
8. Type of treatment (e.g., bioremediation, thermal desorption, soil venting, asphalt incorporation);
9. Final concentrations of contaminants in soil (include analytical results from the lab); and
10. Final disposition of soil including address, property owner and operator, exact location of soil with map showing placement and depth.

NOTES

APPENDIX A

WAC 173-340-450 RELEASES FROM UNDERGROUND STORAGE TANKS.

(1) Purpose. The purpose of this section is to set forth the requirements for addressing releases which may pose a threat to human health or the environment from USTs defined under chapter 90.76 RCW and rules adopted therein, including heating oil USTs of greater than 1,100 gallons capacity.

(a) Releases from USTs exempted under chapter 90.76 RCW and rules adopted therein are still subject to all other requirements of this chapter.

(b) Unless the department requires otherwise, UST owners and UST operators shall comply with the requirements in this section after confirmation of an UST release which may pose a threat to human health or the environment.

(2) Initial response. Within twenty-four hours of the UST release, the UST owner or the UST operator shall perform the following actions:

(a) Report the UST release to the department and other authorities with jurisdiction, in accordance with rules adopted under chapter 90.76 RCW and any other applicable law;

(b) Remove as much of the hazardous substance from the UST as is possible and necessary to prevent further release to the environment;

(c) Eliminate or reduce any fire, explosion or vapor haz ards in such a way as to minimize any release of hazardous substances to surface water and ground water; and

(d) Visually inspect any aboveground releases or exposed belowground releases and prevent the hazardous substance from spreading into surrounding soils, ground water and surface water.

(3) Interim actions.

(a) As soon as possible but no later than twenty days following confirmation of an UST release, the UST owner or the UST operator shall perform the following interim actions:

(i) Continue to monitor and mitigate any additional fire and safety hazards posed by vapors or free product which may have migrated from the UST into structures in the vicinity of the site, such as sewers or basements;

(ii) Reduce the threat to human health and the environ ment posed by contaminated soils that are excavated or discovered as a result of investigation or cleanup activities. Treatment, storage and disposal of soils must be carried out in compliance with all applicable federal, state and local requirements;

(iii) Test for hazardous substances in the environment where they are most likely to be present. Such testing shall be done in accordance with a sampling and analysis plan prepared under WAC 173-340-820. The sample types, sample locations, and measurement methods shall be based on the nature of the stored substance, type of subsurface soils, depth to ground water and other factors as appropriate for identifying the presence and source of the release. If contaminated soil is found in contact with the ground water or soil contamination appears to extend below the lowest soil sampling depth, then testing shall include the installation of ground water monitoring wells to test for the presence of possible ground water contamination. Information gathered for the site check or closure site assessment conducted pursuant to rules adopted under chapter 90.76 RCW, which sufficiently characterizes the releases at the site, may be substituted for the testing required under this paragraph;

(iv) The testing performed under (a)(iii) of this subsection shall include, at a minimum, the following:

(A) Benzene, toluene, ethylbenzene, xylene, lead, and total petroleum hydrocarbons where leaded gasoline may be present;

(B) Benzene, toluene, ethylbenzene, xylene and total petroleum hydrocarbons where unleaded gasoline may be present;

(C) Total petroleum hydrocarbons and other appropriate indicator hazardous substances where any petroleum product other than gasoline may be present ;

(D) The hazardous substance stored and any likely decomposition by-products where a hazardous substance other than petroleum may be present; and

(E) Any other tests required by the department; and

(v) Investigate for the presence of free product.

(b) Free product removal. At sites where investigations indicate free product is present, the UST owner or the UST operator shall conduct, as soon as possible after discovery, an interim action to remove the free product while continuing, as necessary, any other actions required under this section. To accomplish this the UST owner or UST operator shall:

(i) Conduct free product removal to the maximum extent practicable and in a manner which minimizes the spread of hazardous substances, by using recovery and disposal techniques appropriate to the hydrogeologic conditions at the site. The objective of free product removal system must be, at a minimum, to stop the free product migration ;

(ii) Properly treat, discharge, or dispose of recovery by-products in compliance with all applicable local, state, and federal regulations and permits; and

(iii) Handle all flammable products safely to prevent fires and explosions.

(4) Reporting requirements. The following reports are required to be submitted to the department:

(a) Status report. Within twenty days after an UST release, the UST owner or UST operator shall submit a status report to the department. The status report shall identify if known, the types, amounts, and locations of hazardous substances released, how the release occurred, evidence confirming the release, actions taken under subsections (2) and (3) of this section, any planned remedial actions, and any results of work done up to the time of the report. This report may be provided verbally to the department.

(b) Site characterization reports. Within ninety days after release confirmation, unless directed to do otherwise by the department, the UST owner or UST operator shall submit a report to the department about the site and nature of the release. This report shall be submitted to the department in writing and may be combined with the twenty -day status report, if the information required is available at that time. The site characterization report shall include, at a minimum, the following information:

(i) The information required for the status report under (a) of this subsection ;

(ii) A site conditions map indicating approximate boundaries of the property, all areas where hazardous substances are known or suspected to be located, and sampling locations. This map may consist of a sketch of the site at a scale sufficient to illustrate this information;

(iii) Available data regarding surrounding populations, surface and ground water quality, use and approximate location of wells potentially affected by the release, subsurface soil conditions, depth to ground water, direction of ground water flow, proximity to and potential for affecting surface water, locations of sewers and other potential conduits for vapor or free product migration, surrounding land use, and proximity to sensitive environments;

(iv) Results of tests for hazardous substances performed under subsection (3)(a)(iii) and (iv) of this section;

(v) Results of the free product investigation required under subsection (3)(a)(v) of this section;

(vi) Results of all completed site investigations, interim actions and cleanup actions and a description of any remaining investigations, cleanup actions and compliance monitoring which are planned or underway; and

(vii) Information on the free product removal efforts at sites where investig ations indicate free product is present. This shall include, at a minimum, the following information:

(A) Name of the person responsible for implementing the free product removal measures ;

(B) The estimated quantity, type, and thickness of free product observed or measured in wells, boreholes and excavations;

(C) The type of free product recovery system used ;

(D) The location of any on-site or off-site discharge during the recovery operation;

(E) The type of treatment applied to, and the effluent qual ity expected from, any discharge;

(F) The steps taken and planned to obtain necessary permits for any discharge;

(G) Disposition of recovered free product; and

(viii) Any other information required by the department.

(5) State remedial investigation and feasibility study.

(a) The scope of a state remedial investigation and feasibility study under this chapter will depend on the informational needs at a specific site and will vary from site to site to avoid the collection of unnecessary information. For sites with UST releases, a state remedial investigation and feasibility study must at a minimum address the elements in WAC 173-340-350 (6)(a), (b), (c)(ii), (c)(iii), (c)(v) through (c)(vii) and (e). The department may require additional information when needed to select a cleanup action. UST owners and operators shall conduct a state remedial investigation and feasibility study for sites where the following conditions exist:

(i) There is evidence that the release has caused hazardous substances to be present in the ground water in excess of the ground water standards promulgated under chapter 90.48 RCW or cleanup levels in WAC 173-340-720 (Table 1);

(ii) Free product is found; or

(iii) Where otherwise required by the department.

(b) UST owners and UST operators shall submit the information collected for the state remedial investigation/feasibility study to the department as soon as practicable. The information may be included with other reports submitted under this section.

(6) If the department d etermines, based on the results of the remedial investigation/feasibility study or other information, that additional remedial action is required, the department may require the UST owner or the UST operator to submit engineering documents as described in WAC 173-340-400.

(7) Unless directed to do otherwise by the department, cleanup actions performed by UST owners or UST operators shall comply with cleanup standards, WAC 173 -340-700 through 173-340-750 and the requirements for the selection of cleanup act ions, WAC 173-340-360.

(8) Independent cleanup actions. In addition to work performed under subsections (2) through (5), and (7) of this section, UST owners or UST operators performing independent cleanup actions shall:

(a) Notify the department of the ir intention to begin cleanup. This can be included with other reports under this section ;

(b) Comply with any conditions imposed by the department to assure adequate protection of human health and the environment; and

(c) Within ninety days of completion of the cleanup action, submit the results of all investigations, interim and cleanup actions and compliance monitoring not previously submitted to the department.

APPENDIX B

DEPARTMENT OF LABOR AND INDUSTRIES

FIELD SERVICE LOCATIONS

Aberdeen	(360) 533-9300
Bellingham	(360) 676-2083
Bremerton	(360) 478-4921
Colville	(509) 684-7415
Ephrata	(509) 574-2291
(Moses Lake & Warden area)	(509) 766-2291
Everett (Region 1)	(206) 290-1404
Kelso	(360) 577-2200
Kennewick	(509) 735-2481
Mount Vernon	(360) 428-1350
Okanogan	(509) 826-7345
Olympia	
Consultation Services	(360) 586-0963
Education & Training	(360) 586-0963
Electrical Utilities & Communications	(360) 753-6504
Explosives; Marine & Dock	(360) 753-6509
Field Office (Region 4)	(360) 753-6501
Port Angeles	(360) 457-2687
Seattle (Region 2)	(206) 281-5470
Spokane (Region 5)	(509) 324-2526
Tacoma (Region 3)	(206) 596-3800
Vancouver	(360) 696-6182
Walla	(509) 527-4437
Wenatchee	(509) 663-1713
Yakima	(509) 454-3740

For answers to Labor and Industrial health and safety questions call any of the following individuals at the Seattle Office.

Jim Catalano	(206) 281-5325
Janine Rees	(206) 281-5476
Christian Bannick	(206) 281-5463
Mac Davis	(206) 281-5442

1-800-423-7233

Division of Industrial Safety and Health
P.O. Box 44600
Tumwater, Washington 98504-4600

APPENDIX C

WAC 173-340-820 SAMPLING AND ANALYSIS PLANS.

(1) General. A sampling and analysis plan shall be prepared for all sampling activities which are part of investigation and remedial actions unless otherwise directed by the department and except for emergencies. The level of detail required in the sampling and analysis plan may vary with the scope and purpose of the sampling activity. Sampling and analysis plans prepared under an order or decree shall be submitted to the department for review and approval.

(2) Contents. The sampling and analysis plan shall specify procedures which ensure that sample collection, handling, and analysis will result in data of sufficient quality to plan and evaluate remedial actions at the site. Additionally, information necessary to ensure proper planning and implementation of sampling activities shall be included. References to standard protocols or procedures manuals may be used provided the information referenced is readily available to the department. The sampling and analysis plan shall contain:

(a) A statement on the purpose and objectives of the data collection, including quality assurance and quality control requirements;

(b) Organization and responsibilities for the sampling and analysis activities;

(c) Requirements for sampling activities including:

(i) Project schedule;

(ii) Identification and justification of location and frequency of sampling;

(iii) Identification and justification of parameters to be sampled and analyzed;

(iv) Procedures for installation of sampling devices;

(v) Procedures for sample collection and handling, including procedures for personnel and equipment decontamination;

(vi) Procedures for the management of waste materials generated by sampling activities, including installation of monitoring devices, in a manner that is protective of human health and the environment;

(vii) Description and number of quality assurance and quality control samples, including blanks and spikes;

(viii) Protocols for sample labeling and chain of custody; and

(ix) Provisions for splitting samples, where appropriate.

(d) Procedures for analysis of samples and reporting of results, including:

(i) Detection or quantitation limits;

(ii) Analytical techniques and procedures;

(iii) Quality assurance and quality control procedures;

(iv) Data reporting procedures, and where appropriate, validation procedures.

(3) Available guidance. The department shall make available guidance for preparation of sampling and analysis plans.

APPENDIX D

LOCAL AIR POLLUTION AUTHORITIES

APPENDIX E

NOTIFICATION OF TRANSPORT OR TREATMENT OF
PETROLEUM CONTAMINATED SOILS

This information should be submitted to the local health department when: (1) any amount of soil is transported to another site for treatment (except regional treatment centers) or (2) more than 100 cubic yards of contaminated soil is to be treated on-site.

THIS MATERIAL WILL BE: ☐ Treated on-site
(Check one)

☐ Transported to another location for treatment

☐ Other (specify)

OWNER NAME, ADDRESS & PHONE: _____

FACILITY NAME, ADDRESS & PHONE: _____

DESTINATION OWNER, ADDRESS & PHONE (if being transported): _____

TYPE OF MATERIAL (e.g., gasoline, contaminated soil and rocks): _____

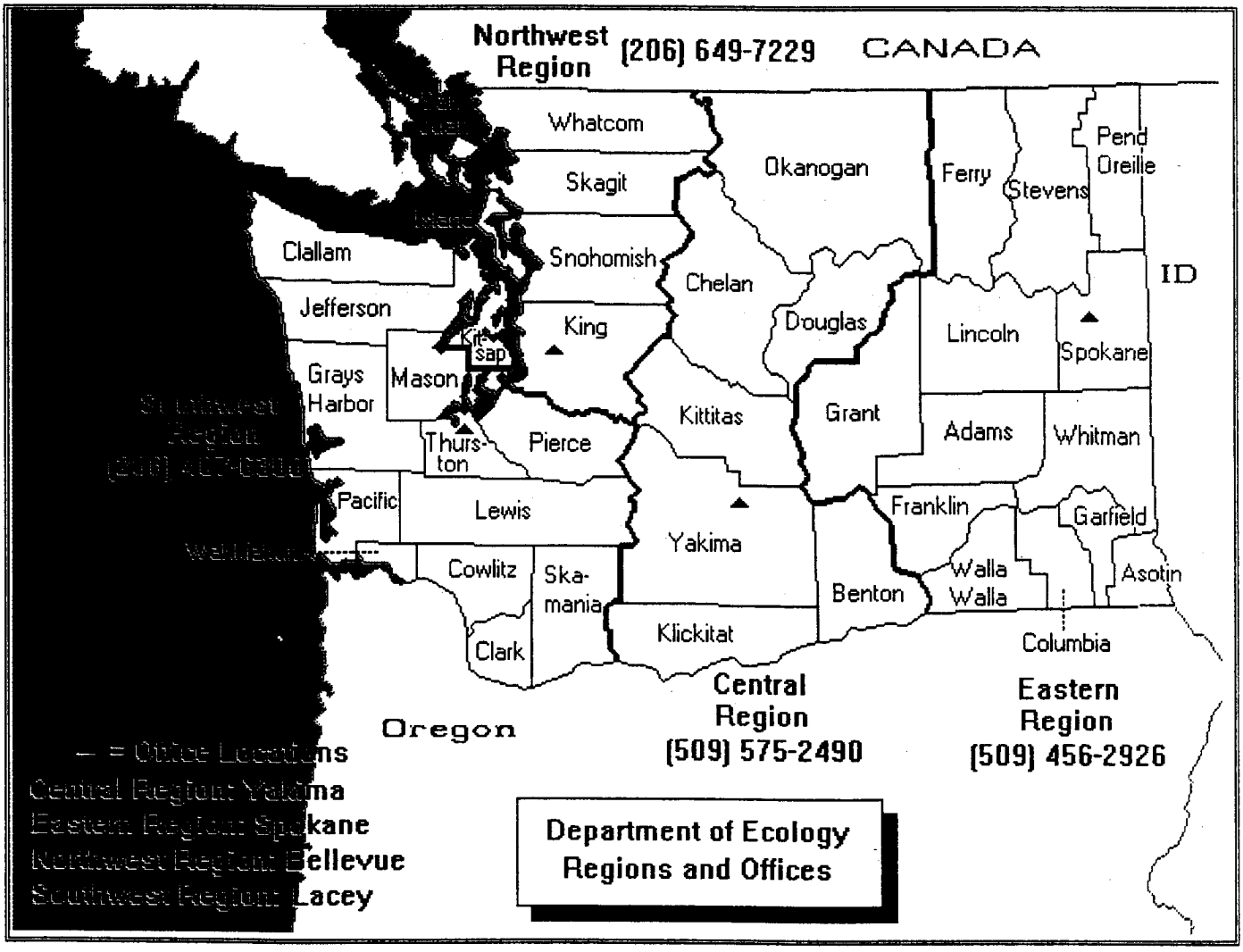
CONTAMINANT CONCENTRATIONS (e.g., 0-5000 ppm TPH, mostly greater than 500 ppm): _____

LAND USE:

Zoning of Site _____
Current Land Use of Site _____
Zoning of Adjacent Area _____
Current Land Use of Adjacent Area _____
Anticipated Future Use of Site _____

APPENDIX F

ECOLOGY REGIONAL OFFICES



Ecology is an Equal Opportunity and Affirmative Action Employer. If you have special accommodation needs, please call (360) 407-6000 (voice) or (360) 407-6006 (TDD).

Eastern Regional Office	Voice: (509) 456-2926
	TDD (only): (509) 458-2055
Southwest Regional Office	Voice: (360) 407-6300
	TDD (only): (360) 407-6306
Northwest Regional Office	Voice: (425) 649-7000
	TDD (only): (425) 649-4259
Central Regional Office	Voice: (509) 575-2491
	TDD (only): (509) 454-7673
Kennewick (Hanford Project)	Voice: (509) 735-7581
	TDD (only): (509) 736-3039

APPENDIX G

WAC 173-304-200 ON-SITE CONTAINERIZED STORAGE, COLLECTION AND TRANSPORTATION STANDARDS FOR SOLID WASTE.

(1) Applicability. These standards apply to all persons storing containerized solid waste generated on-site, and to all persons who are engaged in the collection and transportation of solid waste of more than one single family residence or single family farm including collection and transportation of septage and septic tank pumpings.

(2) On-site storage standards.

(a) The owner or occupant of any premises, business establishment, or industry shall be responsible for the safe and sanitary storage of all containerized solid wastes accumulated at that premises.

(b) The owner, operator, or occupant of any premises, business establishment, or industry shall store containerized solid wastes in containers that meet the following requirements:

(i) Disposable containers shall be sufficiently strong to allow lifting without breakage and shall be thirty-two gallons in capacity or less where manual handling is practiced;

(ii) Reusable containers, except for detachable containers, shall be:

(A) Rigid and durable;

(B) Corrosion resistant;

(C) Nonabsorbent and water tight;

(D) Rodent-proof and easily cleanable;

(E) Equipped with a close fitting cover;

(F) Suitable for handling with no sharp edges or other hazardous conditions; and

(G) Equal to or less than thirty-two gallons in volume where manual handling is practiced.

(iii) Detachable containers shall be durable, corrosion-resistant, nonabsorbent, nonleaking and having either a solid cover or screen cover to prevent littering.

(3) Collection and transportation standards.

(a) All persons collecting or transporting solid waste shall avoid littering, or the creation of other nuisances at the loading point, during transport and for the proper unloading of the solid waste at a permitted transfer station, or other permitted solid waste handling site.

(b) Vehicles or containers used for the collection and transportation of solid waste shall be tightly covered or screened where littering may occur, durable and of easily cleanable construction. Where garbage is being collected or transported, containers shall be cleaned as necessary to prevent nuisances, odors and insect breeding and shall be maintained in good repair.

(c) Vehicles or containers used for the collection and transportation of any solid waste shall be loaded and moved in such manner that the contents will not fail, leak in quantities to cause a nuisance, or spill therefrom. Where such spillage or leakage does occur, the waste shall be picked up immediately by the collector or transporter and returned to the vehicle or container and the area otherwise properly cleaned.

(d) All persons commercially collecting or transporting solid waste shall inspect collection and transportation vehicles monthly, for repairs to containers such as missing or loose-fitting covers or screens, leaking containers, etc., and maintain such inspection records at the facility normally used to park such vehicles or such other location that maintenance records are kept. Such records shall be kept for a period of at least two years, and be made available upon the request of the jurisdictional health department. [Statutory Authority : Chapter 43-.21A RCW. 85-22-013 (Order 85-18), § 173-304-200, filed 10/28/85.]

APPENDIX H

REGIONAL TREATMENT CENTER LIST

PETROLEUM CONTAMINATED SOILS

April 1994

The following is a list of existing or proposed regional treatment centers for petroleum-contaminated soils (PCS) in Washington State. This list does not constitute an endorsement or recommendation of these facilities by the Department of Ecology.

*[**Note**: Those PCS treatment facilities which only accept PCS soils from the county in which they are located are not listed below.]*

ECOLOGY REGION	FACILITY NAME LOCATION AND CONTACT	TREATMENT METHOD
Central Region	Roosevelt Regional Landfill 1800 Roosevelt Grade Road Roosevelt, WA Richard Morck 1-800-275-5641	Aeration
	Anderson PCS Remediation Site 41 Rocky Top Road Yakima, WA Ron Anderson (509) 965-3621	Aeration
	Lower Valley Remediation Service P.O. Box 477 801 Grandridge Road Grandview, WA 98930 Stuart Fricke (509) 882-1144, FAX (509) 882-4566	Aeration & Bioremediation
	Taneum Recovery Corp. Route 1, Box 533 PO Box 1419 Ellensburg, WA Frank Ragland or Bill Bakamus (509) 964-2363, mobile (509) 856-7400	Aeration & Bioremediation
Southwest Region	Woodworth & Company 2800 104th St. So. Tacoma, WA 98421 Mike Skrivan (360) 383-3585	Thermal desorption

ECOLOGY REGION	FACILITY NAME LOCATION AND CONTACT	TREATMENT METHOD
Southwest Region (continued)	FIELDS SHOTWELL Corp. 484 Eclipse Parkway Eclipse Industrial Park Port Angeles, WA 98362 Candace Shotwell (360) 457-1417	Thermal treatment & Recycling
Northwest Region	Sterling Asphalt 6431 NE 175th Kenmore, WA Sam Johnson (206) 485-5667	Asphalt incorporation
	Associated Sand & Gravel 6300 Glenwood Ave. Everett, WA Dale Surdyk (206) 355-2111	Thermal desorption (Permit pending Will have permit by approx. 5/1/94)
	Holnam Cement 5400 West Marginal Way S.W. Seattle, WA 98106 Scott Hoard (206) 937-8025	Cement incorporation
Eastern Region	Remtech, Inc. 9109 West Electric Ave. Spokane, WA Keith Carpenter (509) 624-0210	Thermal desorption