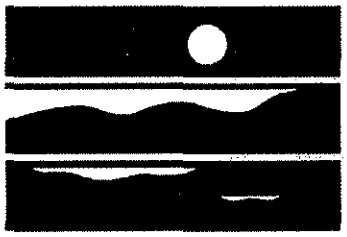

Site Hazard Assessment Guidance and Procedures for Washington Ranking Method

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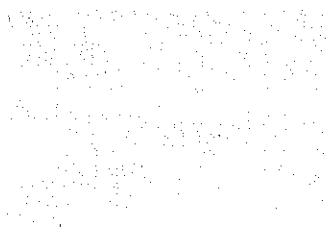


PREFACE

The purpose of this document is to provide a resource manual of selected guidance and reference sources for conducting site hazard assessments (SHAs) sufficient in scope for the scoring, and eventual hazard ranking of, hazardous waste sites using the Washington Ranking Method (WARM).

An overall SHA guidance is presented, along with standard Ecology procedures for performing SHA and site ranking activities, supported by the following appendices:

A) General Sampling Considerations, along with Sampling Plan and Health and Safety Plan Checklists, and Summary of Containers, Preservation, and Holding Times

B) SHA Data Collection Summary Sheets (SHADCSS) - Used to condense, and combine into a single resource document, all the environmental information, along with reference sources, necessary to then score the applicable routes;

C) Scoring Worksheets - Used to summarize the scoring values and document their referenced sources. Once the applicable migration route pathway scores are calculated, either manually or using such as a Lotus 1-2-3 program for WARM, they are entered onto the Scoring Summary Sheet;

D) Ranking can proceed only following the entry of pathway scores into the respective statewide scoring database for determination of overall quintile values, or using established ranges of scores based on previous rankings. The most recently applied ranges of pathway scores for quintile value assignments are presented, to enable tentative rankings of sites to be made.

E) Ecology Procedure 320: Site Hazard Assessment and Ranking of Model Toxics Control Act Sites.

ACKNOWLEDGMENTS

There are many Ecology Toxics Cleanup Program (TCP) staff to whom I am indebted for review/comment during the development of this guidance and procedures manual on site hazard assessments for the Washington Ranking Method. In particular, I would like to thank Pete Kmet, Policy and Technical Support Section Head, for his comprehensive and constructive review from start to finish of this project, plus Lydia Lindwall, and the TCP Management Team, for their help in writing the procedures portion. I would also like to recognize the contributions, enhanced by putting into "hands-on" practice in the field, of the regional office site assessment personnel: Judy Aitken, Elaine Atkinson, Patti Carter, Dick Heggen, Mark Peterschmidt, and Bob Swackhamer.

CONTENTS

Site Hazard Assessment Guidance/Procedures
for
Washington Ranking Method

APPENDICES

Site Hazard Assessment
Guidance/Procedures
Washington State Department of Ecology
Toxics Cleanup Program

1.0 INTRODUCTION

One of the first steps in the hazardous waste site cleanup process under the Model Toxics Control Act (MTCA) is a site hazard assessment (SHA). Its purpose, as defined under Chapter 173-340-320 WAC, is to provide sufficient sampling data, and other environmental information, to:

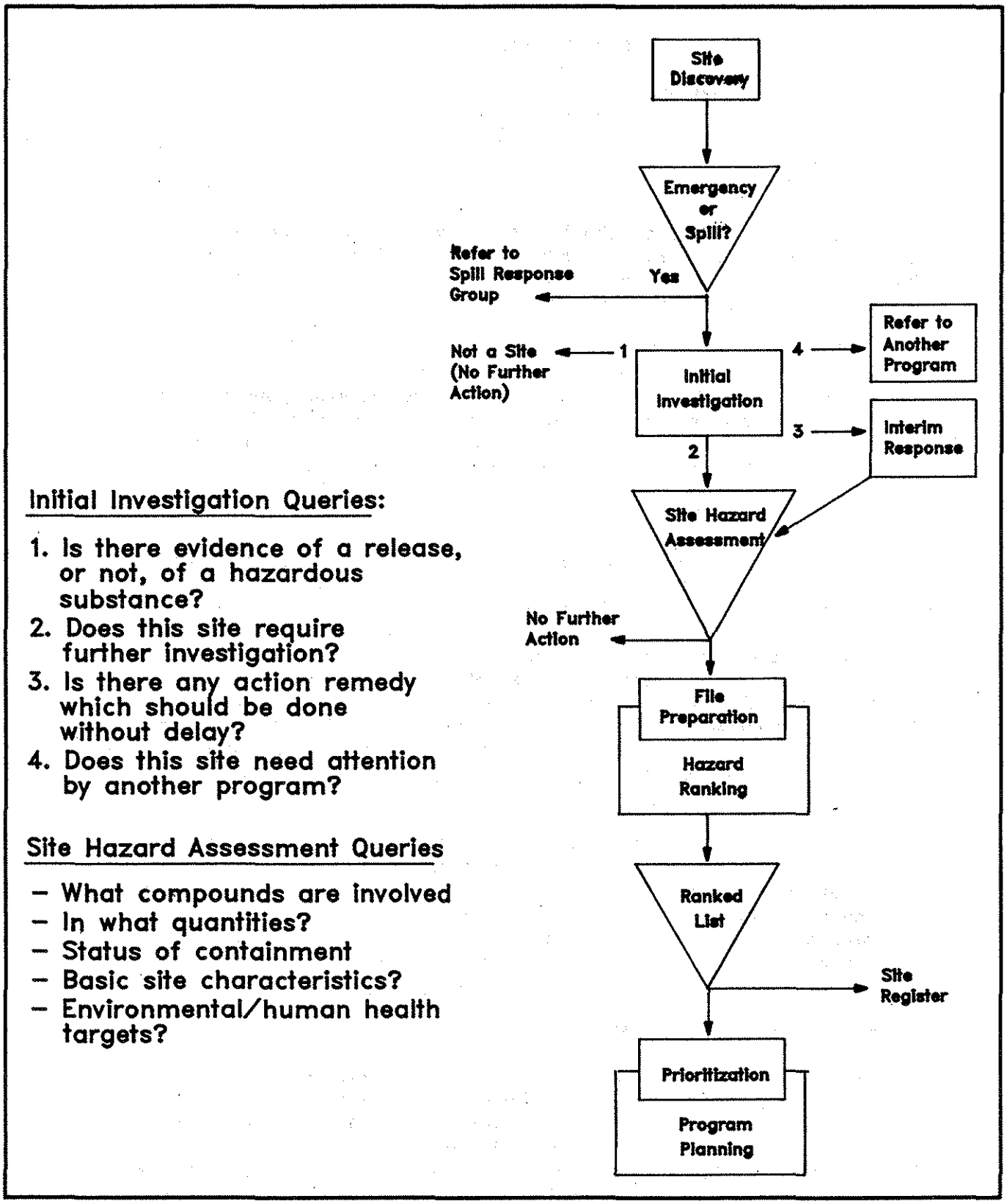
a) Confirm or rule out that a release or threatened release of a hazardous substance(s) has occurred;
b) Identify the hazardous substance and provide some information regarding the extent and concentration of the substance(s);
c) Identify site characteristics that could result in the hazardous substance(s) entering and moving through the environment;
d) Evaluate the potential for the threat to human health and the environment; and
e) Determine the hazard ranking of the site, if appropriate, by the Washington Ranking Method (WARM), under Chapter 173-340-330 WAC, using the WARM Scoring Manual.

The SHA guidance and procedures presented herein are directed primarily towards fulfilling the data requirements for migration route pathway scoring, and subsequent hazard ranking of hazardous waste sites by the Washington Department of Ecology (Ecology), utilizing the WARM Scoring Manual. This manual is not intended to serve as a definitive guidance for complete environmental assessments/audits, such as for determining landowner/lender liabilities in real estate transactions.

Of the four possible exposure routes to be considered for scoring purposes under WARM, only the surface water, air, and ground water routes are discussed here. Guidance for conducting SHAs, and migration pathway scoring, for the sediment route component will be available as separate appendices. SHAs, along with their resultant hazard rankings which place sites on the state's Hazardous Sites List, are key elements of Ecology's pre-remedial process illustrated by Figure 1.

2.0 NOTIFICATION REQUIREMENTS

SHAs are typically carried out for sites where this is the recommended choice of action, following an Initial Investigation (II) as defined under Chapter 173-340-310 WAC. Ecology will send notification to the site owner, operator, and any other known potentially liable person(s) (PLP) of this decision, prior to publication, on a semiannual basis, in its Site Register. Written notice of not less than three days, or twenty-four hours notice by telephone, shall be given to the site owner and/or operator that access to the site is required, prior to the



Initial Investigation Queries:

1. Is there evidence of a release, or not, of a hazardous substance?
2. Does this site require further investigation?
3. Is there any action remedy which should be done without delay?
4. Does this site need attention by another program?

Site Hazard Assessment Queries

- What compounds are involved
- In what quantities?
- Status of containment
- Basic site characteristics?
- Environmental/human health targets?

Figure 1
PRE-REMEDIAL PROCESS

commencement of any on-site activities deemed essential for the completion of the SHA (such as field sampling, see Section 4), as provided under Chapter 173-340-800 WAC.

The department shall make available the results of the SHA to the site owner and/or operator, and any other person(s) who received a potentially liable person status letter under Chapter 173-340-500 WAC regarding the site. If, after the SHA, it is found that no further action (NFA) is required at the site, Ecology shall also publish this decision in its Site Register, following notification of the site owner/operator.

The department will provide copies of the documents and factual information on releases or threatened releases, obtained through SHAs, to persons who request such in accordance with Chapter 42.17 RCW and Chapter 173-03 WAC.

Notification will also be made, as necessary, to the Natural Resource Damages Coordinator, Ecology Toxics Cleanup Program, regarding those sites where an SHA reveals a potential for natural resource damage.

3.0 GENERAL DATA REQUIREMENTS

Due to the great diversity of sites being assessed statewide, it is not practical to present detailed, site-specific guidance in terms of the overall data requirements. However, in order to score the three exposure routes covered in this guidance document, for the eventual hazard ranking of a site, the following categories of data elements must be identified (these will be discussed in more detail in Section 6):

- Specific hazardous substances present on-site
- Waste/substance management activities/practices
- Toxicities/mobilities/quantities of hazardous substances
- Evaluation of containment features
- Route migration potential elements
- Human and environmental targets
- Evidence of any release of hazardous substances

In essence, a determination has to be made regarding which hazardous substances are available through which pathways (routes), due to lack of containment, to which human and/or environmental targets.

As previously mentioned, guidance for scoring a sediment route associated with an assessed site, and incorporating any pathway scores into the final site hazard ranking, will be presented as a separate appendix to this manual. Specific scoring procedures and policy for the sediment route will thus not be presented in this document, other than Figure 2, which summarizes the required environmental data elements. It is important to note that this scoring procedure currently applies only to contaminated marine sediments in Puget Sound.

The remaining components necessary for an SHA to meet Ecology's

FIGURE 2: SEDIMENT ROUTE SCORING FOR WASHINGTON RANKING METHOD
Data Elements Summary

	Source*
I. Environmental Hazard Score	
1. Substance Characteristics:	
Chemical toxicity -	
Exceedance factor: Measured concentration divided by Sediment Quality Standard (SQS)	(Table 1)
Chemical loss factor - Solubility	(Table 3)
Areal extent - Square yards	(Table 4)
2. Site Characteristics:	
Habitat quality -	
Depth value	(Table 5)
Habitat complexity	(Table 6)
Recovery potential -	
Recovery factor	(Table 7)
3. Targets:	
Special marine habitat	(Table 8)
Refuge or sanctuary	(Table 9)
II. Human Health Hazard Score	
1. Substance Characteristics:	
Overall (net) toxicity -	
Chemical toxicity - Chronic	(Table 10)
- Acute	(Table 11)
Carcinogenicity potency factor	(Table 12)
Bioaccumulation potential -	(Table 13)
Octanol-water partition coefficient (K_{ow}) - organics	
Bioconcentration factors (BCFs) - metals	
Enrichment ratio - Chemical concentration divided by Reference Area Concentration	(Table 2)
Overall toxicity score	(Table 16)
2. Site Characteristics:	
Same as above for environmental hazard score.	
3. Targets:	
Commercial fisheries	(Table 14)
Recreational fisheries	(Table 15)

*Sediment Route Scoring Procedure Appendix

purposes, while in themselves are not always essential requirements for route scoring, include, but are not limited to, the following:

- Official site name/any known alias(es)
- Address, legal description of site (township/section/range)
- Name(s)/address(es) of owner(s)/operator(s)
- Descriptive narrative/site history. A narrative description of the site, or facility as defined under Chapter 173-340-200 WAC, along with a summary of all known past activities related to waste management practices, forms an integral part of an SHA. As this occurs at a relatively preliminary stage in the overall site characterization process, best professional judgment is needed, following a comprehensive file review, to adequately delineate the site as "Any area ... where a hazardous substance, other than a consumer product in consumer use, has been deposited, stored, disposed of, or placed, or otherwise come to be located." (In other words, the boundaries of a "site" may extend beyond the boundaries of the property of concern.) The narrative should include, but not be limited to:

    - Type of facility
    - Description of past/present operations
    - Probable waste/substance management activities/practices
    - Description of any prior spills (size, type, location)
    - Brief summary, and quality assessment, of any existing sampling/analytical data
    - History of methods of hazardous substance/waste disposal, storage, handling
    - Reference and summary of any manifests/waste records
    - Regulatory involvement: permits/violations
    - Emergency or removal actions
    - Affected, or potentially affected, human and environmental targets, on or near the site.

Other essential elements of an SHA include, as appropriate:

- Site map detailing significant environmental features, location(s) of hazardous substance source(s), targets along with any other information believed to be important (e.g. general vegetation types, site zoning, land use of surrounding areas, using a 7.5' USGS topo. quad. map)
- Photographs, with log, of important environmental features, sample locations, targets, etc.
- Representative monitoring/drinking water well logs
- Sample/health and safety plans
- Quality assurance/quality control (QA/QC) parameters
- Investigative wastes disposition
- Assessment of potential for damage to natural resources
- Assessment of any endangered species or other species of special concern, and species used of human food consumption.

4.0 FIELD SAMPLING

Once a comprehensive site file review has been completed, a decision can be made whether to conduct any on-site field sampling activities. Analytical information from appropriate environmental media may be deemed necessary at this stage in the SHA process to ensure that all essential environmental data elements are available for scoring purposes. These samples may be required because either no previous, or relatively recent, on-site sampling/analyses are known to exist, or to confirm, due to lack of adequate documentation (QA/QC) or reception of new site information, the identity of any hazardous substance(s) on-site, or potentially migrating offsite.

Environmental samples collected during an SHA generally consist of (suspected) contaminated soils and/or ground water and/or surface water, along with a reference (background) sample, as appropriate. (Sampling objectives are discussed in more specific detail in Section 4.3.) Where there are no available ground water wells, either monitoring or drinking water, on site for sampling, a decision has to be made up front as to the utility and cost-effectiveness of installing one or more monitoring wells. Completion, and any subsequent abandonment, of any installed monitoring wells is to be in accordance with Ecology's Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160 WAC).

Prior to commencing sampling, it is necessary to first prepare an appropriate sampling and analysis plan (SAP), as defined under Chapter 173-340-820 WAC, as well as a health and safety plan (HASP) consistent with Chapter 49.17 RCW. General sampling considerations and checklists for SAPs and HASPs are presented in Appendix A. More detailed SAP guidance is available in the Ecology Toxics Cleanup Program (TCP) Sample and Analysis Plan Guidance Manual (in draft, April 1992).

The SAP shall specify procedures which ensure that sample collection, handling, and analysis will result in data of sufficient quality to meet the needs of an SHA. References to standard protocols or procedures manuals (standard operating procedures, or SOPs) may be used provided such referenced information is readily available. Some examples of SHA activities which might be described in SOPs include, but are not limited to, the following:

- Selection of sampling sites
- Sampling and analytical methodology
- Special precautions for handling samples
- Selection and use of field instruments
- Calibration and standardization of analytical procedures
- Routine preventive maintenance
- Collection of replicate and blank samples
- Documentation and sample chain of custody
- Data assessment procedures.

At a minimum, the SAP should sufficiently detail, as applicable, the following information:

4.1 Site Description/History

For the purposes of an SHA SAP, a sufficient narrative could consist of a summary of the major features of the SHA narrative, with an emphasis on known/suspected waste/substance management activities/practices, potential routes of exposure, prominent/unusual environmental features, and affected or potentially affected human and/or environmental targets.

4.2 Field Personnel/Dates of Activities

All personnel associated with the field activities, along with their designated responsibilities, should be identified. A time schedule of all proposed sampling activities is essential in terms of assuring the samples will be analyzed at an appropriate laboratory within acceptable turnaround times.

4.3 Sampling Objectives

Sampling objective procedures described herein pertain generally to meeting the minimal requirements of an SHA for the purposes of scoring and ranking the site under WARM. It is imperative that the site assessor have an awareness of all the ranges of environmental data elements used in scoring the various routes, and the respective values assigned, as detailed in the WARM Scoring Manual, prior to developing a sampling strategy. This will allow a more judicious allocation of expended effort and expense throughout the SHA process.

Not considering the obvious benefit of documenting an observed release through one or more of the three routes for scoring purposes (though this data element can account for as little as only 5% of the maximum score for any one route), valid sampling/analytical results could also contribute to fulfilling the following information needs:

- Establishment, or confirmation, of (chemical) identification of hazardous constituents - for toxicity evaluation
- Equally important, to document the absence of significant (i.e. above background) contaminant concentrations. This could likely lead, along with other considerations, to a decision of no further action (NFA) for the site
- Aid in the estimation of substance quantities, e.g. through soil sampling, when this factor is based on the amount of contaminated soil at a site, rather than "pure product"
- Aid in the understanding of containment features of waste management units
- Along with containment knowledge, specific hazard constituent identification is essential in making a determination regarding substance mobility in the air and ground water routes
- Help to characterize on-site soils, through soil borings, where local/regional data is deficient/lacking, for assignment of permeability/hydraulic conductivity point values

- Depth to water table, from deepest point of known contamination, can be determined more precisely through soil boring and/or ground water sample analyses
- Extend the boundaries of the site, to minimize target distances, when it can be shown unequivocally that the off-site contamination documented originated from the initial site area
- Determine groundwater flow direction, where this is not readily available through other means, for establishing background
- Evaluate potential for natural resource damage through identification/assessment of stressed biota

4.4 Sampling Locations/Types/Frequency

The site assessor must use best professional judgment, based on all available site information, in deciding site-specific sampling locations, how many samples to collect from each environmental medium, and which analyses to have performed. A balance must be achieved between ensuring that all associated data element needs are met, and any additional associated efforts/costs involved (e.g. documentation, chain-of-custody, analytical turnaround time, disposal of investigative wastes, necessity of rinsate/transfer blanks, etc.) due to an increase in sample numbers beyond an absolute minimum.

Environmental sampling for scoring and ranking sites under WARM does not entail a thorough site characterization, as would be done in a more formal environmental audit, nor does it support an absolute, quantitative risk assessment of a site. Rather, the emphasis is upon designing a "one-shot" sampling event to identify specific hazardous contaminants, zeroing in on those site-specific waste management practices/activities and suspected waste substances which are of the most practical and realistic concern.

A thorough and comprehensive knowledge of all containment features of each potential route of exposure must be ascertained in order to determine all applicable pathway(s), and in turn, sampling location(s). This is arrived at through a combination of file review, field inspections and interviews, and best professional judgment. The bulk of the Site Hazard Assessment Data Collection Summary Sheets (or SHADCSS, see Appendix B) is devoted to recording containment information for eventual scoring purposes.

The required number of environmental samples to be collected during an SHA is a function of many factors to be considered:

- Past sampling history, if any; how recent?, state of documentation?
- Number and types of identified waste/substance management activities/practices
- Number of available routes of exposure (due to less than 100% perfect containment)
- Required level of QA/QC

A background (offsite or upgradient) sample from the same medium is necessary to establish significance for those compounds expected to naturally occur in the environment (e.g. metals), or be present due to suspected offsite/upgradient contaminant sources. For man-made compounds, such as chlorinated hydrocarbons, any concentration reported above the detection limit for that compound indicates a significant occurrence of that substance and it may be considered for the purposes of scoring under WARM, especially as the model is not concentration dependent.

4.5 Sampling Methods/Containers/Preservation

All sampling methods employed during an SHA should follow established SOPs, and referenced as such. Appropriate sample containers and preservation techniques should follow guidance procedures detailed in Ecology Manchester Laboratory's "Laboratory Users Manual, Third Revision, July 1991" (pages 27-32), as summarized in Ecology Environmental Investigations and Laboratory Services (EILS) Program "Guidelines and Specifications for Preparing Quality Assurance Project Plans" Appendix B (see Appendix A of this document.)

4.6 Analytical Considerations

The employment of best professional judgment is necessary to determine specific analyte requirements for any environmental samples collected during an SHA. Just as the sampling efforts are to be directed at those waste/substance management practices/activities of greatest practical and realistic concern, analytical requests typically should be for those specific hazardous constituents believed, on the basis of existing site information, to pose the greatest and most realistic threat to human health and/or the environment.

Where there is little or no information available about past on-site hazardous waste practices, best professional judgment, as described in Section 4.4, should be followed regarding sampling locations, types, and frequency, with full priority pollutant scans run on a smaller number of samples taken from what are believed to be the "worst" locations.

4.7 Sampling Equipment Decontamination

Soil sampling and/or monitoring well installation activities during an SHA may result in exposures of hazardous substances to both field personnel and their associated equipment. (Overall preventive measures for the former, in terms of prior preparation of a safety plan, will be discussed in the following section.) Potential exposures to sampling and monitoring equipment, to be discussed here, generally range from slightly to moderately contaminated soils and/or water to essentially pure product, where a "hit" of a "hot spot" occurs.

It is imperative that appropriate steps are taken throughout an SHA to minimize the potential for any such exposure, as well as to effectively decontaminate (decon) field equipment, and properly dispose of any

investigation-derived wastes (investigative wastes). This is especially critical in those instances where repeated sampling activities are likely to occur to prevent cross-contamination of the sampling media and repeated exposure to hazardous substances by sampling personnel.

The use of dedicated and/or disposable sampling equipment and protective clothing should be utilized as much as practicable to minimize the need for any decon in the field. Nondisposable equipment, tools and other materials should be deconned on-site following prescribed SOPs. Sampling equipment that must be used repeatedly can be deconned between sampling events by the following general procedure:

- Brush off visible mud/dirt; scrub and wash with clean water. Organic-free water, distilled water, or tap water may be used; the tap water source must be noncontaminated.
- Scrub and wash with trisodium phosphate.
- Rinse with tap water.
- Final rinse with deionized or distilled water.

Upon completion of any drilling activities, all equipment including the drill rig and all casing, rods, tools, and miscellaneous equipment must be deconned before leaving the site. The drill rig and equipment are usually cleaned with a steam cleaner or mobile high-pressure hot water washer. Wipe tests may be used to determine the extent of remaining contamination, if any; this testing is particularly relevant when a commercial well driller has been used as a contractor.

In rare cases, contaminated equipment or tools may have to be shipped back to the office or laboratory for additional decon. In these instances, the site assessor must alert and discuss this with the appropriate designated person(s) prior to performing the sampling and before shipping the items.

4.8 Investigative Wastes Disposition

It is intended that state and federal rules and guidance are used in determining if investigative wastes, resulting from SHA activities, contain hazardous substances. The handling, treatment, or disposal of any such investigative wastes must satisfy all state and federal requirements that are applicable or relevant and appropriate to the site location and the amount and concentration of the hazardous substances, pollutants, or contaminants involved.

The movement, containment, treatment, and disposal of hazardous wastes within an area of contamination (AOC), defined as that portion of a site which contains continuous contamination, do not automatically trigger the Dangerous Waste Regulations (Ecology Interprogram Policy on Area of Contamination, September 6, 1991). During the SHA stage, however, the AOC will probably not be fully defined. Special care must be taken by field personnel to ensure that investigative wastes are handled properly. Generally, drill cuttings and well purge and development water should be drummed and analyzed. These wastes should be disposed

of according to Dangerous Waste and/or Water Quality Regulations on the basis of their eventual analyses. The storage requirements of the Dangerous Waste Regulations should be evaluated to determine proper handling practices for any drummed soil wastes. At a minimum, drums should be properly labeled, adequately secured, and regularly inspected.

Generally, due to the relatively small quantities generated, SHA-generated investigative wastes such as disposable sampling equipment and protective clothing (e.g. gloves, booties) can be disposed of at a state permitted, licensed, or registered municipal or industrial solid waste landfill. It is recommended that SHA personnel adequately document the disposal of any investigative waste. This should describe the logic that was used in applying knowledge and judgment to the designation of any investigative waste, especially when the materials were not analyzed for the waste characteristics.

A separate, more detailed, guidance document on investigative wastes is currently in preparation by Ecology TCP staff.

4.9 Quality Assurance/Quality Control (QA/QC) Procedures

Samples must be collected following adequate QA/QC procedures to ensure representative and reliable results. The validity of both sampling techniques and laboratory procedures must be assured so that the resultant analytical data can be used to accurately document the presence or absence of contamination at the site.

4.9.1 Laboratory QA/QC

Chapter 173-340 WAC requires that all hazardous substance analyses be performed by laboratories accredited under Chapter 173-50 WAC unless otherwise approved by the department. A listing of laboratories accredited to perform water analyses can be obtained from EILS. All surface water and ground water samples should be submitted only to one of these accredited laboratories for analysis.

A similar accreditation program for soil analysis does not presently exist, but is anticipated to be established within a few years. In the meantime, soil samples, to be analyzed for hazardous substances, should be submitted to laboratories which routinely use appropriate QA/QC procedures that are at least as stringent as those identified in the Laboratory Users Manual, copies of which can be obtained from the Manchester Laboratory.

Analyses of the following quality control samples should be routinely run, and commonly are done so by Manchester Laboratory, to provide information for interpreting the accuracy, precision, and detection capabilities of the analytical procedures used:

- Check standards - estimates the precision of the method and to check for bias due to calibration

- Duplicate analyses of samples - checks the precision of the actual samples
- Matrix spikes - tests for bias due to chemical interference from the sample matrix
- Blanks - estimates the method detection limit and checks for laboratory contamination.

One of the following approaches can be used to verify that the proper QA/QC procedures are being followed by the laboratory:

- Obtain a letter from the laboratory director stating that the laboratory operates and maintains records of its QA/QC program for samples from SHAs and that their results meet the standards identified in this document; or

- Obtain from the laboratory the QA/QC results run with each batch of laboratory analyses performed, for addition to the detailed records of the SHA. QA/QC data is to be reviewed by the site assessor and a summary ultimately delivered to the owner/operator along with other documented results of the SHA.

4.9.2 Field QA/QC Assurance

Field QA/QC should include one duplicate sample collected for each sampled matrix to provide an estimate of the total variability in the sampling and analytical procedures. Duplicate samples submitted to the laboratory must be given a unique identifying number.

Field blanks should be used to address specific problems or legal requirements. They are unnecessary for most parameters unless there is reason to expect problems with contamination. Field blanks are to be treated as ordinary samples by the laboratory. However, they should be clearly identified so that they are not selected for use as duplicates or matrix spikes. The site assessor should evaluate the potential for contamination of samples during field operations and select blanks accordingly:

Transport (or trip) blank - should accompany samples collected for each sampled matrix, generally for volatile analytes.

Transfer blank - the appropriate sampling container is filled with a suitable blank substance, along with any preservative(s) used for the environmental samples, sealed and kept with the other samples throughout the entire sampling event. Results will indicate any contamination from the container, the surroundings where the transfer took place, and/or the preservative(s) used.

Rinsate (or sampling or equipment) blank - a suitable blank substance is exposed to any sampling equipment used repeatedly, following a standard decontamination procedure, to check for possible cross-contamination from the sampling equipment.

The use of dedicated sampling equipment (bailers, wooden tongue depressors or separate stainless steel spoons for soil samples, etc.) generally eliminates the need for rinsate and transfer blanks.

4.9.3 Documentation of Field Activities

A field notebook should be maintained by the sampling team to record times, dates, and locations of all samples as well as daily events, observations, field measurements, and any other applicable information obtained during the SHA. It is recommended that all entries be made in ink in bound notebooks of "write-in-the-rain" type paper, with each page signed and dated. It is important to note that, following an SHA, the written comments recorded in the field notebook become public record and cannot be destroyed.

Where practical, photographs should be taken of each sampling location and of any unusual circumstances encountered. In order for these to be effective documentation, the accompanying information should be entered into the assessor's field notebook, or on an adequate field map:

- Date
- Time
- Number of the photo on the roll
- Type of film, lens, and camera used
- Photographed by (signature)
- Name and ID number (if any) of the site
- Location of area within site which is photographed
- General direction faced when photo taken
- Any other appropriate comments (e.g. weather).

Photograph negatives should be suitably labeled and filed for further use, if needed.

4.9.4 Handling/Referring Possible Civil/Criminal Actions

SHAs are not normally carried out for compliance monitoring inspection purposes, whereby observations of permit/regulation violations would likely result in a recommendation to be made for some type of enforcement action. If, during the course of an SHA, questionable practices or site conditions are noted, it is incumbent upon the site assessor to suitably document these facts, without compromising the objectives of the SHA. A summary of these observations should be forwarded, as appropriate, to either the respective regional office or the Ecology Criminal Investigations Unit, following completion of all on-site activities.

4.9.5 Chain of Custody

All samples should be placed immediately in appropriate containers (see Section 3.4) which should be tightly sealed, decontaminated and cooled

on ice. Samples should be labelled with the following information:

- Unique identifying laboratory number assigned to the sample
- Date and time of collection
- Site name and location of sample
- Name of person collecting sample
- Project name
- Analyses requested; and
- Preservation method used, if any.

A chain of custody sheet must be completed for all samples collected. This sheet shall be maintained from the time the samples are collected to the time they are submitted to the laboratory. It should include:

- Sampler's name
- Sample container type and number
- Date and time of collection
- Sample collection location(s)
- Analyses to be performed
- Date and signatures of those releasing and receiving the samples
- Date and time samples were received by the laboratory; and
- Total number of samples received.

Sample custody seals must be used when samples are shipped to the laboratory, or when they are delivered to the laboratory after hours. The seals must be signed by the sampler and be affixed to the sample cooler in a way that would necessitate breaking the seal in order to open the cooler. If the samples are delivered directly to the laboratory by the sampler, sample seals are not necessary. Chain of custody procedures are detailed in the "Laboratory User's Manual".

For more detailed QA/QC guidance, refer to EILS's "Guidelines and Specifications of Preparing Quality Assurance Project Plans".

5.0 SAFETY

The required site HASP should sufficiently detail the following:

a) Brief site description/history
b) Sampling objectives
c) Personnel
d) Waste/hazardous substance types/characteristics
e) Chemical/physical hazards
f) Site entry/control procedures/monitoring
g) Work effort/personal protection considerations (action levels)
h) Emergency facilities/telephone numbers/routes/maps
i) Emergency contacts.

For more detailed safety plan guidance, refer to WAC 296-62-P, or Ecology's "Integrated Health and Safety Policy for HWICP (now TCP) Field Employees".

6.0 SPECIFIC DATA ELEMENTS

6.1 Hazardous Substances of Concern

Identification of specific chemical compounds is essential in the scoring, and subsequent ranking, of a site as this allows the assignment of toxicity point values. This can be accomplished through one of the following, listed in order of decreasing preference:

i) Waste analyses or environmental monitoring data
ii) Material identification (e.g. degreasing solvent as trichloroethene through product label)
iii) Process knowledge or process control information
iv) Site activities/waste stream characterization

6.2 Waste/Substance Management Activities/Practices

As well as identifying all hazardous wastes/substances present at a site, their management activities/practices must also be determined. These may include one or more of the following:

- Disposal:
  - Drain fields
  - Dry wells
  - Landfills
  - Surface impoundments
  - Waste Piles

- Storage and/or treatment
  - Containers, including drums, tank trucks, and other portable storage units
  - Stock piles, outdoor storage areas, waste piles
  - Surface impoundments
  - Tanks

- Spills, releases
  - Contaminated soil, or ground/surface water due to spillage or leakage from a source that has been removed or not identified
  - Releases or spills from process or operating areas to any environmental medium
  - Spills to soil, surface water
  - Unpermitted discharges to soil/ground water, surface water, or air.

6.3 Toxicity

Since both human and environmental receptors are targeted under WARM, it is necessary to obtain toxicity scoring values for both using one or more of the following measures:

- Human toxicity:

  Drinking water or ambient air standards (refer to the WARM Scoring Manual for data types in order of preference);

  Acute toxicity (LD_{50} or LD_{LO} for water, and LC_{50} or LC_{LO} for air);

  Chronic toxicity (AIC-Oral, RfDs or NOAEL/LOAEL for water, and AIC-Ihl, RfDs or NOAEL/LOAEL for air);

  Carcinogenicity (EPA Weight of Evidence Rating Factor value X EPA CAG Carcinogenic Potency Factor value: oral for water, inhalation for air);

- Environmental toxicity:

  Surface water - use Acute Standard for Protection of Aquatic Life, i.e. Quality Criteria for Water, as published in the EPA "Gold Book". Note that there are variations in these values according to freshwater or marine environments; if not available, use non-human mammalian acute toxicity (LD_{50} or LD_{LO});

  Air - Use non-human mammalian acute inhalation (LC_{50} or LC_{LO}).

Toxicity values for hazardous substances can be obtained from the following sources:

- Washington Department of Health, Physical, Chemical, Toxicological and Regulatory Values for Priority Pollutants
- Quality Criteria for Water, 1986, U.S. EPA
- Registry of Toxic Effects of Chemical Substances, U.S. DSHS
- Farm Chemicals Handbook
- Toxic Air Contaminant New Source Review Guidelines, Ecology
- EPA's Integrated Risk Information System (IRIS)
- Registry of Toxic Effects of Chemical Substances (RETECH)
- EPA's Office of Drinking Water Health Advisories

Toxicity scoring values, for WARM scoring, are listed for 210 chemicals in Ecology's Toxicology Database for Use in WARM Scoring.

6.4 Mobility of Hazardous Substances into/through Environmental Media

The mobility data element accounts for the inherent chemical/physical characteristics of a hazardous substance which govern its tendency to move into and through the air and ground water components of the model. This factor is not evaluated for the surface water migration route. For the air and ground water routes, the following elements are considered:

- Air Route
  - Particulate transport
    - Soil types - From SCS soil type maps
    - Climatic factor - Refer to map on page A-6, WARM Scoring Manual
  - Gaseous transport
    - Use vapor pressure for concentrated solutions, or when soil is contaminated, and gaseous transport appears more important than particulate, or when it is not certain in what matrix the hazardous substance is contained; use Henry's Law Constant if the hazardous substance is an aqueous solution.

- Ground Water Route
  - Inorganic contaminants (cations/anions) - Use Coefficient of Aqueous Migration, along with knowledge of media pH (see page GW-4, WARM Scoring Manual)
  - Organic contaminants - Use water solubility (mg/l)

6.5 Substance Quantity

The process of calculating the hazardous substance quantity factor value is the same for each of the three routes. It is necessary to determine how the substances are contained in the management unit(s), and then assign a value from the substance quantity equivalence tables appropriate to the total quantities present (and available). For substance spills, use the quantity spilled when known, otherwise use the areal extent in square feet (note that the two tables in the WARM Scoring Manual for the air and surface water routes are not equivalent) or volume in cubic yards (for the ground water route) of the contaminated soil.

6.6 Containment

It is necessary to determine the method(s) by which any hazardous substances present on site are contained or managed. An evaluation is then made of containment values for those hazardous substances available to the routes under consideration. In selecting the waste management units to be used for containment scoring in each route, a two-step process is used to determine if the substances present in the unit are available to the route of concern. First, the containment measure used to protect the route of concern is identified. Then, a determination is made that if the containment failed, whether or not there would be a release to the route of concern. Complete containment does not necessarily rule out the scoring of a route, but will result in a very low score. Components for containment considerations include:

- Landfills
- Surface impoundments
- Above-ground containers and tanks
- Waste piles
- Spills, discharges, and contaminated soil.

For the air route, the containment evaluation is based on the most likely type of release (gaseous or particulate). Containment conditions for all routes are to be scored as they existed at the time of an SHA, taking into account any interim remedial actions taken to mitigate releases from the site. The hazardous substance quantity to be used is the total quantity available to the route being scored.

If a site contains multiple hazardous substances and containment types, the procedure on pages 12 and 13 of the WARM Scoring Manual must be used to identify the unit and waste combination which gives the higher product of these two data elements and their adjustment factors.

6.7 Route Migration Potential Data Elements

Data elements (environmental factors) which may affect the migration of the identified hazardous substance(s) in available surface and ground water routes, along with their sources, are listed below. Note that WARM does not utilize such elements in evaluating the air route, as typically there is a lack of suitable environmental factors affecting both gaseous and particulate transport of substances from a site.

Route Migration Data Element	Data Source
SURFACE WATER ROUTE	
Surface soil permeability (Based on soil types)	° On-site soil samples ° Soil Conservation Service soil survey for WA state
Total annual precipitation	° NOAA Atlas 2, Vol. IX (2-year 24-hour precipitation) ° Climatological Data Annual Summary
Floodplain	° Department of the Army Hydrology and Hydraulics Branch ° Ecology Flood Insurance Rate Maps
Terrain slope between site and nearest downgradient surface water	° 7.5 X 15 Minute Quad. maps
GROUNDWATER ROUTE	
Net precipitation - use the total precipitation and evapotranspiration from Nov. through April, where monthly data is available.	° National Weather Service publications for WA state

GROUND WATER ROUTE (Cont.)

Route Migration Data Element	Data Source
Subsurf. hydraulic conductivity	° On-site files ° WA state and USGS water reports and geologic reports ° On-site field observations
Vertical depth to aquifer from greatest depth of known soil contam. to water table	° On-site files ° On-site field observations ° Local/regional studies

6.8 Targets

As with the other portions of the model, the targets module is not designed to evaluate potentials for direct contact, as it has been assumed that any response(s) to any imminent hazard(s) would have been undertaken prior to any site assessment/scoring activities.

Targets Data Element	Data Source
SURFACE WATER ROUTE	
Distance to nearest surface water body	° Field observations/measurements ° USGS topographic map
Population served by surface water drinking water intakes within two miles of site (all intakes within lakes, downstream only in rivers/streams	° DOH Public Water Supply System Databases
Private/Public water supply sources (see above)	° WA Water Rights Information System (WRIS) Databases
Area irrigated by surface water intakes within two miles downstream	° WRIS Databases
Fishery resources	° WA Department of Fisheries, A Catalog of Washington Streams and Salmon Utilization, Vol. 1, Puget Sound, WA Dept. of Health
Shellfish	° Third Annual Inventory of Commercial and Recreational Shellfish Areas in Puget Sound, June 1990

6.8 Targets (Cont.)

Targets Data Element	Data Source
AIR ROUTE	
Nearest population - distance to nearest dwelling, public building or park	° Site file ° USGS topographic map ° Field observations
Total population within half mile of site	° Count buildings on a 7.5 min. USGS topographic quad map ° Most recent Federal Census data ° Population and Housing Estimates from Puget Sound Council of Government, April 1989 ° Local City or County Planning Department
Sensitive environments within 0.5 mile radius - State Endangered Species - Washington Natural Heritage	° Dept. of Wildlife, Non-game Div.
Wetlands - Within 1.0 mile of site	° Dept. of Ecology ° National Wetlands Inventory Maps
Federal Wilderness Areas - State or other Parks - State Game Lands	° USGS topographic maps ° WA Atlas and Gazetteer ° Road map
Potential for Natural Resource Damage	° Natural Resource Trustees
GROUNDWATER ROUTE	
Distance to nearest drinking well within 2 miles	° DOH Public Water Supply, and WRIS Databases
Private wells within 2 miles	° Ecology regional office well log files
Groundwater usage	° Site files ° Database utilized for determining the population served
Sole-source aquifers	° Maps of Designated and Petitioned Sole Source Aquifers in the state, EPA, Region X

GROUND WATER ROUTE (Cont.)

Targets Data Element	Data Source
Total population served by drinking water wells within 2 miles	° DOH Public Water Supply, and WRIS Databases
Acreage irrigated by wells within 2 miles	° DOH Public Water Supply, and WRIS Databases

6.9 Release

The release module for each route is designed to add "bonus" points to the route score should a definable release be substantiated through visual or analytical evidence. The latter must demonstrate that the concentration of the hazardous substance measured is at least three times expected or measured background (if the compounds are expected to be present in the environment, such as metals).

Release Data Element	Data Source
SURFACE WATER ROUTE	
Permit conditions out of compliance. Visual evidence of overland flow or discolored plume or analytical evidence	° National Pollutant Discharge Elimination System (NPDES) ° Site files ° SHA
AIR ROUTE	
Direct visual evidence of particulate or gaseous release or analytical evidence	° Site files ° SHA
Detectable odors	° Identifiable source + analyt. data
GROUNDWATER ROUTE	
Direct dumping such as in a dry well, or presence of bottom of waste pile below water table, or analytical evidence	° Site files ° SHA

7.0 PROCEDURES FOR SITE HAZARD ASSESSMENT AND RANKING OF MODEL TOXICS CONTROL ACT (MTCA) SITES

7.1 Introduction

As stated earlier, this manual has been written to provide guidance for conducting SHAs sufficient in scope to score hazardous waste site migration route pathways, using the WARM Scoring Manual, for ranking by Ecology. Those sites which have their assessments completed, and are recommended for further remedial action, are ranked and placed on Ecology's Hazardous Sites List, along with their respective hazard rankings. Updates to this list are routinely published in Ecology's Site Register, in the February and August Special Issues.

Only those sites which have been ranked and added to Ecology's Hazardous Sites List can be placed on the TCP Program Plan for further investigation and remedial action. A site's WARM ranking is not necessarily always synonymous with its priority for remedial action. However, sites with a ranking of 1 or 2 generally will be given higher priorities than those ranking a 3, 4, or 5. Other site-specific factors, besides the WARM rank, which can be taken into consideration in setting remedial action priorities at sites on the TCP Program Plan are detailed in: **Interim Policy 340: Priority Setting for Sites.**

Specific procedures detailing the Ecology TCP pre-remedial assessment process, from site selection through hazard ranking, are described below. The reader should also refer to **Procedure 320: Site Hazard Assessment and Ranking of MTCA Sites**, presented in Appendix E.

7.2 Site Selection Process

Typically, sites enter into Ecology's pre-remedial assessment process as a result of initial investigation recommendations by field staff at one of the four regional offices, Industrial Section or TCP Cleanup Section. It is required under MTCA that whenever Ecology receives information and has a reasonable basis to believe that there may be a release, or a threatened release, of a hazardous substance which may pose a threat to human health and/or the environment, that an initial investigation be conducted within 90 days. The major features of MTCA initial investigation (Chapter 173-340-310 WAC) are:

- An initial investigation must be conducted within 90 days of site discovery and reporting.
- Investigation includes:
  - site visit, and
  - documentation of conditions observed.
- Within 30 days of completion, one (or more) of the following decisions must be made:
  - A site hazard assessment is required;
  - Referral to another program;

- An interim action (or even an emergency remedial action) is required; or
- The site requires no further action (NFA) under this chapter at this time because either:
    - There has been no release or threatened release of a hazardous substance; or
    - A release of threatened release of a hazardous substance has occurred but, in the department's judgment, does not pose a threat to human health or the environment.

-If further study or action is needed, an early notice letter is sent, inviting the owner and/or operator to work cooperatively with Ecology.

Since the Hazardous Sites List updates in the Site Register are published at six-monthly intervals, SHAs are typically carried out in suitably sized "batches" which can be completed over six-month periods. Each Site Register Special Issue will thus also include a list of all sites designated by the regional offices as "high priority" for further investigation, based on the results of their respective completed initial investigations. SHAs for these sites are required to begin within 180 days of the Site Register publication date, and be completed, along with their hazard ranking, within a further 180 days of the scheduled start date.

Other sites, not initially designated as high priority, may be scheduled for SHAs at any time during a six-month interval if Ecology determines they warrant expedited action. These follow the normal course of events, to be described below, as the high priority SHAs, except they do not need to be listed beforehand in the Site Register. They will be added to the Hazard Sites List, depending upon the outcome of their assessment/ranking, and listed in both a Site Register Special Issue and the biennial report to the Washington Legislature.

Lists of tentative sites for SHAs for each coming six-month period, most of which shall ultimately become designated as high priority, are submitted by the regional office site assessment staff (site assessors), at least a month prior to the end of each current six-month assessment period (and publication of a new Site Register Special Issue), to the TCP headquarters-based site ranking coordinator. (This would be by mid-January, and mid-July, according to the current publication schedule of the Site Register.)

One of the functions of the site ranking coordinator is to serve as TCP point of contact with the U.S. Environmental Protection Agency (EPA) in implementing the EPA/Ecology Hazardous Site Assessment Agreement between the two agencies, signed in October 1991. Through exchange of site listings and status reports with EPA Region X, and expertise in the EPA pre-remedial site assessment process, the site ranking coordinator will be able to screen out any inappropriate sites proposed for SHAs by the regional site assessors. This may be due to the site being either

already at an advanced stage of site assessment/ranking in the EPA pre-remedial process, or exhibiting known environmental features which indicate it should be added to the EPA Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) List for further assessment as a potential National Priority List (NPL) candidate.

Following review/comment of the tentative site lists by the site ranking coordinator, the site assessors will submit their final lists of proposed sites for SHAs to their respective regional office, Cleanup Section, or Industrial Section, site assessment unit leaders. The assessment unit leaders will further review, with additional input from other TCP staff as appropriate, and approve the site lists. These may include only those sites which are now "officially" designated as high priority for further investigation, and will be published in the upcoming Site Register Special Issue as such, or may additionally include sites which will be assessed/ranked on a time available basis during the upcoming six-month period.

The site assessor will then notify the:

- Respective owner/operator(s) that an SHA of their site is scheduled within the coming six months, and request any recent site-specific information which may be available. This communication (by letter preferably, or by telephone call and follow-up letter) must reach the owner/operator(s) of any site designated as high priority before publication of that site in the Site Register;

- Department of Health Hazardous Waste Section, Tumwater, of the finalized list of upcoming SHAs for that region, high priority or otherwise, with a schedule of site visits, if known at that time;

- Site Register Coordinator, TCP headquarters, of the finalized list of upcoming high priority SHAs for that region for publication in a Site Register Special Issue;

- Site ranking coordinator, of the finalized list of upcoming SHAs for that region, high priority or otherwise, with a schedule of site visits, if known at that time.

7.3 Pre-Site Hazard Assessment Activities

Once the site lists are finalized, the site assessors can begin to collect, as available, file information relevant to the environmental data element needs of the SHA data collection summary sheets (SHADCSS), ensuring that documentation is made of all data sources/references for later use. This not only helps fulfill the specific data requirements

for WARM scoring point assignments, but also aids the site assessor to become familiar with the site prior to any site reconnaissance.

A site specific sampling and analysis plan (SAP), as well as a health and safety plan (HASP) must be prepared for any site where it is decided, for any of the number of reasons discussed earlier in this manual, that environmental samples need to be collected to adequately assess the site for ranking purposes. The assessment unit leaders are responsible for approving these plans; however review/comment on specific aspects of SAPs and HASPs may be requested of TCP SAP and HASP guidance/procedures development personnel, respectively, as appropriate.

Where the technical scope of work and/or analytical demands exceed the site assessor's capability to proceed with, and complete, an SHA in a timely and adequate manner, it may be necessary to request the assistance of a TCP contractor. Specific TCP procedures are available for initiating this action. Refer to **PRO PFM 310: REQUESTING A CONTRACTOR.**

The regional office, Cleanup Section, or Industrial Section, section head shall review all applicable work plans for those sites where the scope of work and/or projected budget of a contracted SHA exceeds established TCP standard guidelines. They will approve/disapprove the work plan and/or budget variances, and make appropriate recommendations to the site assessment unit leader. The site assessment unit leader will then notify the site assessor to proceed with the SHA where the requested variance(s) are approved, or if not, what recommended alternatives/options were made which place the scope of work and/or budget within standard guidelines.

Whether the sampling is done by the site assessor, or contracted out, it is the responsibility of the site assessor to submit a Request for Analysis Form to Manchester Laboratory for those samples to be analyzed by that laboratory. This must be done in adequate time to ensure reservation of laboratory time/space, and allow for the proper sample containers and ice chests to be sent back to the site assessor. Refer to Appendix A and the "Laboratory Users Manual" for more specific guidance/procedures about analytical requests and appropriate sample containers.

7.4 Site Hazard Assessment

Once all the notifications have been made, and sampling equipment/plans, etc. are in order (where required), the site assessor will proceed with the SHA. This may be done in one or two phases, depending on the various circumstances regarding the site, e.g. its physical location, difficulty in accessing the owner/operator, the type/timing of samples to be collected, etc. There may be an initial drive-by reconnaissance, with only a very brief site visit to an office or a house which is not the site property, per se, to meet with the owner/operator to obtain information about the site, with a follow-up on-site visit later where

sampling may or may not take place; or all of this may be accomplished through only one site visit.

The site assessor will generally be accompanied by at least one other regional office staff and/or a representative from the DOH during any field work conducted for an SHA. The site ranking coordinator will also be available, on an as-needed basis, for assistance in any and all SHA activities, such as:

- Collecting environmental samples per the SAP;
- Completing on-site data gaps in the SHADCSS;
- Witnessing, taking photographs;
- Delineating applicable migration pathways, receptor targets;
- Documentation, note-taking;
- Quality assurance;
- Completing Analysis Required Forms;
- Submitting samples to the laboratory;
- Initiating chain of custody procedures;
- Disposition of investigative wastes; or
- Evaluating potential for natural resource damages.

The site assessors should ensure, prior to leaving the site, that all site-specific data gaps in the SHADCSS (e.g. containment features; physical indicators such as stained soil; terrain slope; distances, if applicable, to nearest surface water, sensitive environment, fishing resources, drinking water well, or population; etc.) are completed.

7.5 Migration Pathway Scoring

Once the SHADCSS are completed for a site, the site assessor can complete WARM Scoring Sheets 1 through 6, using the WARM Scoring Manual and the Toxicology Database for Use in WARM Scoring for point value assignments. The site ranking coordinator will review all completed worksheets, and/or give assistance during the actual scoring process, to assure both accuracy and state-wide consistency in the application of the WARM model.

Calculation of the applicable route migration pathway scores are done either manually, using the formulae on pages 19 and 20 of the WARM Scoring Manual, or with the use of a Lotus 1-2-3 computer program. (These calculations will be checked by the site ranking coordination as necessary.) Once all pathway scores are calculated, the Summary Scoresheet for each site is completed.

Prior to pathway scoring, and subsequent formal ranking of the site, any NFA decisions must be made. These are based on criteria listed above in Section 7.2; i.e. where it was documented either there had been no release or threatened release of a hazardous substance, or if one had occurred that it did not pose a threat to human health or the environment. One of the goals of a successful SHA is to determine, at its conclusion, whether or not a "significant" on-site release has occurred. Guidance on how to determine whether a site should continue

to be handled as a cleanup site under MTCA when this is not clear-cut is under development by the TCP.

Where there has been a release, the calculated pathway scores can give an indication of the significance of any threats to human health and/or the environment, as they reflect the relative overall contribution of toxicity, quantity, containment features, and human and environmental targets effects. A certain element of best professional judgment may additionally be required to arrive at a final disposition for the site. It is important to note here that placement of a site on Ecology's Hazardous Sites List initiates a commitment of follow-up remedial action by the TCP. A formal delisting process is then required to be completed prior to removal of a site from the list.

7.6 WARM Ranking

7.6.1 Quintile Values

A site's rank is a function of the quintile placement for each of its applicable route migration pathway scores. The site ranking coordinator develops and maintains the "master" lists of finalized pathway scores for all TCP SHAs conducted to date. All new scores from sites assessed (and not designated as NFA) for both the February and August updates each year are added to their respective cumulative lists, in an ordinal sequence, only each August.

The total number of scores for each of the five currently utilized pathways (see note about sediments at the conclusion of this section):

- Surface Water - Human Health
- Surface Water - Environmental
- Air - Human Health
- Air - Environmental
- Ground Water - Human Health

is divided by five to establish the number of sites within each "new" quintile grouping. When there is a remainder (e.g. a total 258 site scores would mean 51 in each quintile with 3 "left over") an adjustment has to be made to the number in that many quintiles by the addition of no more than one additional score, in its proper ordinal sequence, until there are no remainders. Inspection of the overall new list will show where these remainder number of scores can best be inserted into the ordinal sequence such that the "breakages" (i.e. difference between the lowest score of one quintile and the highest score of the quintile immediately below it) are maximized.

Once the new quintiles are established for each of the five pathways, a table of ranges can be developed, as shown in Appendix D and again below, to allow for the determination of the quintile value for each new score, or alternatively, they can be obtained by reading directly off the new score lists. For the February update, the ranges developed the preceding August are to be used to determine quintile values, rather

than adding in all the new scores, and re-establishing quintile groupings, at that time. There are currently only insignificant changes in the range of scores for any one quintile value through each update of a small number of new scores due to the relatively larger number of site scores already present in each of the five pathway lists.

The range of scores associated with quintile values for the August 1991 hazardous sites list update are: (Note: see Appendix D for August 1997 update.)

I. Human health pathway scores

Quintile No.	Surface Water	Air	Ground Water
5	>28.5	>34.6	>55.3
4	21.2 - 28.5	21.3 - 34.6	43.6 - 55.2
3	14.4 - 21.1	13.3 - 21.2	36.7 - 43.5
2	5.0 - 14.3	6.3 - 13.2	29.0 - 36.6
1	<5.0	<6.3	<29.0

II. Environmental pathway scores

Quintile No.	Surface Water	Air
5	>49.9	>33.1
4	32.3 - 49.9	22.1 - 33.1
3	23.1 - 32.2	8.7 - 22.0
2	9.2 - 23.0	0.1 - 8.6
1	<9.2	<0.1

Note: Guidance and procedures for assessing and scoring a fourth migration route, Puget Sound contaminated sediments, are in preparation and will allow Sediment - Human Health and Sediment - Environmental pathway scores to be incorporated into a site ranking, where this route is applicable.

7.6.2 Priority Values

The human health and environmental priority values are calculated once all the quintile values are obtained for all applicable migration route pathways for each site, using the equations on page 21 of the WARM Scoring Manual. As shown by the first example, the highest, middle and lowest quintile values are mathematically combined to yield the two final overall priority values for sites where the sediment route is not applicable.

Where there is no score calculated for any other route pathway than sediment, because of also not being applicable to that site, a value of zero is used in the priority calculation. This is different from circumstances resulting in a pathway score of 0.0 (generally due to no targets being within the target distances), where the quintile value is

always a one. It is important to note that all fractional values are rounded up to the next highest whole number.

When there is no score calculated for a priority, it will be noted as "NA" for not applicable. To date this has occurred generally only for such sites as leaking underground storage tanks (LUST) where there are no air or surface water route migration pathways due to sufficient ground cover. (An exception to this is when contaminated ground water from a LUST site is documented as discharging to surface water. Both the surface water-human health and surface water-environmental pathways may be scored here.)

7.6.3 Final Site Ranking

The matrix on page 22 of the WARM Scoring Manual is used to obtain site rankings, once overall priority scores are calculated. Two main features of the matrix are that a human health priority value of five always results in a site rank of a 1, no matter what the environmental priority is for that site; and the "NA" column is to be used when the respective priority score was not able to be calculated.

7.6 Distribution

The site assessors distribute lists of the new sites and their proposed rankings, to be added to the Hazardous Sites List, to all appropriate TCP field staff for concurrence on each site's ranking. Any issues regarding specific site rankings will be resolved to the satisfaction of the affected site manager, the site assessment unit leader, the site assessor, and the site ranking coordinator prior to publication in the Site Register. The Special Considerations Section of the Summary Scoring Sheet shall be used to address any human health and/or environmental concerns believed not to be represented through a site's final ranking.

The site assessors then notify the site ranking coordinator and site register coordinator of all final site rankings, and any sites designated as NFA. The site ranking coordinator should also be supplied with two copies of each finalized scoring package, and SHADCSS where completed, at that time. Where these scoring packages are not fully completed, the summary score sheet should be made available at a minimum, for distribution by the site ranking coordinator to the TCP public information officer. The site assessors must notify the owner/operator(s) of their site ranking by letter, or telephone call with a follow-up letter, prior to its publication in the Site Register, as detailed in Appendix E.

During this same period of time, the site assessors should have been repeating the procedure discussed in Section 7.2 for selection of new high priority sites for SHAs so they can also be published in the Site Register.

The site ranking coordinator will notify the EPA Region X site assessment unit leader of the newly listed sites and their rankings after the owner/operators have been notified, but prior to publication in the Site Register. One copy of each site final scoring package will be made available by the site ranking coordinator to the DOH to assist them in their health investigation efforts on MTCA ranked sites.

8.0 REFERENCES

U.S Environmental Protection Agency, 1990. Guidance for Conducting Preliminary Assessments with the Revised Hazard Ranking System. Section 3.

Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Quality Assurance Section, 1991. Guidelines and Specifications for Preparing Quality Assurance Project Plans.

Washington State Department of Ecology, Toxics Cleanup Program, April 1990, Revised April 1992. Washington Ranking Method Scoring Manual.

Washington State Department of Ecology, Manchester Environmental Laboratory, 1991. Laboratory Users Manual.

Washington State Department of Ecology. Minimum Standards for Construction and Maintenance of Wells. Chapter 173-160 WAC.

Washington State Department of Ecology, Sediment Management Unit, 1991. Washington Ranking Method (WARM) - APPENDIX - Sediment Scoring Route.

Washington State Department of Ecology, Solid and Hazardous Waste Program, 1990. Ground Water Monitoring Guidance for Solid Waste Facilities.

Washington State Department of Ecology, Toxics Cleanup Program, 1989. Integrated Health and Safety Policy for HWICP Field Employees.

Washington State Department of Ecology, Toxics Cleanup Program, 1992. Toxicology Database for Use in WARM Scoring.

Washington State Department of Ecology, Underground Storage Tank Program. 1991. Guidance for Site Checks and Site Assessments for Underground Storage Tanks.

Washington State Department of Health, Office of Toxic Substances, Hazardous Waste Program, 1991. Physical, Chemical, Toxicological and Regulatory Values for Priority Pollutants.

APPENDIX A

SITE HAZARD ASSESSMENT SAMPLING

General Considerations

These actions apply to all samples and sampling media. Failure to address these will result in inconsistencies within the sampling program and possibly contaminated samples.

- Before commencing collection of samples, thoroughly evaluate the site. Observe the number and location of sample points, landmarks, references, and routes of access or escape.

- Record pertinent observations. Include sketch identifying sample locations.

- Prepare all sampling equipment and sample containers prior to entering site. Protective wrapping can be utilized to minimize cross-contamination.

- Place sample containers of flat, stable surfaces for receiving samples. Use sorbent materials to control spills, if any.

- Plan to collect samples first from those areas that are suspected of being the least contaminated so that areas of suspected contamination are collected last, thus minimizing the risk of cross-contamination.

- Collect samples and securely close containers as quickly as feasible. Where possible, make any required field observations (pH, temperature, conductivity) at the source rather than in the containers.

- Follow the Sampling and Analysis Plan in every detail. Document all steps in the sampling procedures, especially noting any deviations.

- For potentially hazardous samples, dispose of sampling gear as determined in the sampling plan, or carry it back to the contamination reduction area in a plastic bag for decontamination.

- For potentially hazardous samples, deliver the sample containers and equipment to the decontamination station for cleaning prior to further handling.

- Always be attentive to the potential hazards posed by the sampling procedures and the material sampled.

Adapted from A Compendium of Superfund Field Operations Method, December 1987, U.S. Environmental Protection Agency, Washington, D.C., EPA/540/P-87/001.

SITE HAZARD ASSESSMENT SAMPLING AND ANALYSIS PLAN CHECKLIST

Activity	Completed	Not Applicable
1. Site Description/History	_____	_____
2. Key Personnel Identified	_____	_____
3. Request for Analysis form submitted	_____	_____
4. Sampling:		
Proposed date of field activities	_____	_____
Objectives	_____	_____
Locations	_____	_____
Types	_____	_____
Frequency	_____	_____
Methods	_____	_____
Containers	_____	_____
Preservatives	_____	_____
Equipment decontamination	_____	_____
5. Investigative wastes disposition	_____	_____
6. Site-specific analytical considerations	_____	_____
7. Field Sample Data and Chain-of-custody Sheet Completed	_____	_____

SITE HAZARD ASSESSMENT SAFETY PLAN CHECKLIST

Activity	Completed	Not Applicable
1. General:		
Site name/address	____	____
Project manager	____	____
Plan preparer	____	____
Review/approval	____	____
Proposed date of field activities	____	____
2. Sampling Objectives	____	____
3. Key Personnel/Duties Identified	____	____
4. Site/Waste Characteristics:		
Site description/history	____	____
Waste types	____	____
Waste locations	____	____
Est. volumes of chemicals/wastes	____	____
5. Hazard Summary:		
Chemical		
Specific	____	____
Overall	____	____
Physical		
Specific	____	____
Overall	____	____
Confined space	____	____
Emergency exit situations	____	____
5. Hazard Evaluation:		
Physical	____	____
Chemical:		
Hazard evaluation sheet for each major known/suspected contaminant- with a summary sheet covering:	____	____
Ionization potential (eV); PEL/TWA; Route of exposure; Acute symptoms; Odor threshold; Odor description	____	____
6. Site Safety Workplan		
Site control:		
Perimeter identified	____	____
Work areas designated	____	____
Zone(s) of contamination identified	____	____
Site entry procedures	____	____

Activity	Completed	Not Applicable
6. Site Safety Workplan (Cont.)		
Special considerations	_____	_____
Special site equipment/facilities	_____	_____
Work limitations	_____	_____
7. Personnel Protection:		
Specific tasks-vs-level A/B/C/D	_____	_____
Modifications:		
Action Levels-		
Organic vapors	_____	_____
Oxygen	_____	_____
Combustible gases	_____	_____
Dust	_____	_____
Radiation	_____	_____
Air Monitoring:		
Contaminants of concern	_____	_____
Monitoring equipment	_____	_____
Decontamination:		
Solutions	_____	_____
Procedures	_____	_____
Sample handling procedures	_____	_____
Contaminated protective wear	_____	_____
Investigative wastes disposal	_____	_____
7. Emergency Information (Telephone nos.):		
Ambulance	_____	_____
Fire Emergency	_____	_____
Hospital Emergency	_____	_____
Poison Control Center	_____	_____
8. Emergency routes	_____	_____

CONTAINERS, PRESERVATION AND HOLDING TIMES

Parameter	Container	Sample Size(mL)	Preservation	Holding Time
Acidity	Poly or Glass	100	Cool, 4°C	14 Days
Alkalinity	Poly or Glass	100	Cool, 4°C	14 Days
BOD_5	Poly or Glass	2000	Cool, 4°C	48 Hours
COD	Poly or Glass	100	Cool, 4°C, H_2SO_4 to pH < 2	28 Days
Chloride	Poly or Glass	100	None	28 Days
Color	1-L Cubetainer	100	Cool, 4°C	48 Hours
Conductivity	Poly	1000	Cool, 4°C	28 Days
Cyanide	Poly or Glass	500	Cool, 4°C, 0.6 g ascorbic acid	14 Days
Fluoride	Polyethylene	100	None	28 Days
Hardness	Poly or Glass	100	HNO_3 or H_2SO_4 to pH < 2	6 Months
Ammonia N	Poly	125	Cool, 4°C, H_2SO_4 to pH < 2	28 Days
Kjeldahl N	Poly	125	Cool, 4°C, H_2SO_4 to pH < 2	28 Days
NO_3^--NO_2^- N	Brown Poly	125	Cool, 4°C, H_2SO_4 to pH < 2	28 Days
Metals	Poly	250	HNO_3 to pH < 2(1)	6 Months
Cr^{+6}	Poly or Glass	250	Cool, 4°C	24 Hours
Hg	Poly	250	HNO_3 to pH < 2	28 Days
Oil & Grease	Glass	500	Cool, 4°C, H_2SO_4 to pH < 2(2)	28 Days
TOC	Amber Glass	50	Cool, 4°C, Store in dark, HCl or H_2SO_4 to pH < 2	28 Days
PO_4^{-3} P	Brown Poly	125	Filter immediately, Cool, 4°C	48 Hours

CONTAINERS, PRESERVATION AND HOLDING TIMES (Continued)

Parameter	Container	Sample Size(mL)	Preservation	Holding Time
Total P	Poly	125	Cool, 4°C, H_2SO_4 to pH < 2	28 Days
Solids	Poly or Glass	500	Cool, 4°C	7 Days
Sulfate	Poly or Glass	100	Cool, 4°C	28 Days
Turbidity	Poly or Glass	100	Cool, 4°C	48 Hours
Coliform	Sterile Glass	250	Cool, 4°C, 0.008% $Na_2S_2O_3$	6 Hours(3)
Volatile Organics	Glass, Teflon lined septum	40	Cool, 4°C, 0.008% $Na_2S_2O_3$, HCl to pH 2	14 Days
Phenolics	Glass, Teflon lined lid	500	Cool, 4°C, H_2SO_4 to pH < 2	28 Days
BNAs	Glass, Teflon lined lid	2000	Cool, 4°C, 0.008% $Na_2S_2O_3$	7 Days to extraction, then 40 Days
Pesticides & PCBs	Glass, Teflon lined lid	200	Cool, 4°C	7 Days to extraction, then 40 Days
Chlorophyll	Brown Poly	1000	Cool, 4°C	
TOX	Amber Glass, Teflon lined lid	500	Cool, 4°C, HNO_3 to pH 2, 5 mg Na_2SO_3/L	14 Days

(1) Samples for total metals analysis can be acidified at the lab if they arrive within 24 hours of collection and have been maintained at 4°C from the time of collection. Be sure not to acidify samples for dissolved metals analysis prior to filtration.

(2) Samples for oil and grease analysis can be acidified at the lab if they arrive "within a few hours" of collection and have been maintained at 4°C from the time of collection.

(3) The Manchester Lab Users Manual lists a holding time of 30 hours. EPA is allowing 30 hours as a practical matter.

Soil and sediment samples should be collected in 8 Oz. wide-mouth glass jars with Teflon lid liners. The jar should be nearly full and samples should be cooled to 4°C during transportation and storage.

APPENDIX B

DEPARTMENT OF ECOLOGY
TOXICS CLEANUP PROGRAM

SITE HAZARD ASSESSMENT DATA COLLECTION SUMMARY SHEETS FOR WASHINGTON RANKING METHOD

SURFACE WATER, AIR AND GROUND WATER ROUTES ONLY

Site Name:_____

Location:_____

Site owner/operator:_____

Address:_____

Any other known PLP(s):_____

Address:_____

Date(s) of field site hazard assessment:_____

Samples or field measurements:_____soil
_____surface water
_____air _____ground water

(Attach copies of pertinent sampling and analytical data, as well as all other supporting documentation.)

Photographs:_____

Weather:_____

Lead inspector:_____

Other inspectors:_____

Signature:_____

PART I: Hazardous Substances

NOTE: Page numbers shown by "route" (e.g. SW-2, A-13) in parentheses throughout this checklist refer to the revised WARM Scoring Manual. WK-numbers refer to page numbers of the worksheets at the end of the scoring manual. These are also presented in this guidance in Appendix B.

A. Hazardous substances

List specific hazardous substances, known or suspected (check k or s), currently, or that have been previously (check c or p), at the site property (WK-2, WK-3). Give an estimate, if available, of the **quantity** (not concentration) of each:

Hazardous Substance	K	S	C	P	Quantity	Units
1.						
2.						
3.						
4.						
5.						
6.						

Additional?_____(list on attachment)

By which routes are these available? (WK-2, WK-3)

Number(from above)	Surface Water	Air	Groundwater
1.			
2.			
3.			
4.			
5.			
6.			

References:_____

B. SOURCES

Check those known or observed (WK-2, WK-3):

_____ drums or other containers
_____ electrical transformers
_____ above ground tanks
_____ below ground tanks
_____ ponds, pits, or other impoundments
_____ pipelines (other than water, sewer, or gas)
_____ floor drains
_____ exterior drains for rainwater, surface waters, spills, etc.
_____ other? Identify:_____
_____
_____

C. INDICATORS

Check those known or observed (SW-5; A-8, A-9; GW-6):

_____ discolored soils
_____ disturbed soils
_____ discolored standing water
_____ unusual or noxious odors
_____ sick or dead vegetation
_____ groundwater monitoring wells
_____ other? Identify:_____
_____
_____
_____

If any are checked in B or C, explain details including exact locations (identify location on a map or drawing).

Additional information/references:_____
_____
_____
_____
_____

PART II: Releases

A. KNOWN OR SUSPECTED RELEASES

List those hazardous substances identified (by number) in I.A. which are known, or suspected, to have been released (WK-2, WK-3):

Substance (#)	Quant.Released	Units	Medium Released to

Additional information/reference?_____

B. SOURCES AND IMPACTS (SW-5, SW-6; A-9, A-10; GW-6, GW-7)

List those hazardous substances identified (by number) in II.A. and identify the source and impact:

Substance No.	Source	Impacts/Affects to	Area

Additional information/references:_____

III. Migration Potential

A. CONTAINMENT--LANDFILLS (SW-7; A-11; GW-8, GW-9)

Present?_____ How many?_____

Check those that apply:

1. _____An engineered, maintained run-on/run-off control system
2. _____An engineered/maintained cover without ponding
3. _____Unmaintained run-on/runoff control system or cover
4. _____No run-on/runoff control or no cover
5. _____Uncontaminated soil cover greater than 6" thick
6. _____Uncontaminated soil cover less than 6" thick
7. _____Contaminated soil used as cover
8. _____A functioning vapor collection system
9. _____Mixing or agitation used
10. _____No liner
11. _____Single clay or compacted soil liner (permeability_____cm/sec)
12. _____Single synthetic liner (permeability_____cm/sec)
13. _____Double liner system (permeability_____cm/sec)
14. _____Leachate collection system, maintained and functioning
15. _____Leachate collection system, unknown condition or not functioning
16. _____Liquid wastes may have been disposed of
17. _____Liquid wastes were disposed of in landfill
18. _____Reliable evidence no liquid wastes were disposed

Additional comments/references:_____

B. CONTAINMENT--SURFACE IMPOUNDMENTS (SW-8; A-12; GW-9)

Present_____ How many?_____

Check those that apply:

1. _____The dike is apparently sound

2. _____The dike is regularly inspected and maintained

3. _____There is evidence of failure, erosion, slumping, or release of contents

4. _____Two feet of freeboard maintained automatically

5. _____The freeboard is manually controlled so that there is at least 2 feet of freeboard

6. _____Evidence of insufficient freeboard (<2 ft.)

7. _____A maintained cover

8. _____Unmaintained cover, no cover

9. _____No liner

10. _____Single synthetic liner

11. _____Single clay or compacted soil liner

12. _____Double liner

13. _____Working leak detection system

14. _____Evidence of loss of fluid (other than by evaporation)

Additional comments/references:_____

C. CONTAINMENT--DRUMS AND SMALL CONTAINERS (SW-9; A-10; GW-10)

Present_____ How many?_____

Check those that apply:

1. _____No functional containment

2. _____There is secondary containment capacity for the total volume of containers

3. _____There is secondary containment with capacity for at least 110% of the volume of the largest container

4. _____The secondary containment is less than 110% of the volume of the largest container

5. _____The containers are stored in single, or double layers on pallets,or in racks

6. _____The containers are stored in an unstable manner

7. _____Some containers are open or have visible liquid

8. _____Some containers are leaking

9. _____Containers are protected from weather

10. _____Containers showing deterioration

11. _____Containment surface is impervious

12. _____Containment surface has cracks or semi-permeable

13. _____No base material/permeable base such as gravel/base materials unknown

13. _____Containment is regularly inspected and maintained

14. _____Evidence of containment failure

Additional comments/references:_____
_____
_____
_____
_____
_____

D. CONTAINMENT--STORAGE TANKS (SW-9; A-10; GW-10)

Present?_____ How many?_____

Check those that apply:

1. _____Secondary containment with a capacity of 110% of the volume of the tanks

2. _____Secondary containment at least 50% of the volume of all tanks

3. _____Containment system with capacity for at least 10% of volume of containers or tanks

4. _____No containment, or less than 10% capacity

5. _____Tank volumes maintained

6. _____Automatic controls used for volume maintenance

7. _____Tanks are covered

8. _____Uncovered tanks have aeration, mixing, or heating of tank contents

9. _____Containers sealed, protected

10. _____Containers sealed, not protected

11. _____Containers deteriorated

12 _____Containers leaking

13. Record the #s of above which apply only to above ground tank_____

14. Record the #s of above which apply only to below ground tanks _____

15. Record the #s of above which apply to both above and below ground tanks: _____

Additional comments/references:_____
_____
_____
_____
_____

E. CONTAINMENT--WASTE PILES (SW-10; A-11; GW-11)

Present?_____ How many?_____

Check those that apply:

1. _____Waste pile is outside, no protecting structure

2. _____Waste pile is outside, in open structure with roof

3. _____Waste pile is outside, with partial or unmaintained cover

4. _____Waste pile is outdoors, with maintained cover

5. _____No cover is present

6. _____Waste pile is fully enclosed, intact building

7. _____There is an engineered run-on/run-off control

8. _____The run-on/run-off is maintained

9. _____Run-on/runoff control present, unknown condition

10. _____No run-on/runoff control system present, or unknown if present

11. _____Liner or base present; _____Not present.

12. _____Single clay or compacted soil liner

13. _____Single synthetic liner

14. _____Double liner

15. _____Maintained, functioning leachate collection system

16. _____Leachate collection system;____Unknown condition; or _____Not functioning.

Additional comments/references:_____

F. CONTAINMENT--SPILLS, DISCHARGES, AND CONTAMINATED SOIL

(SW-10; A-12; GW-12)

Check those that apply:

1. _____Spill, discharge, or contaminated soil only in the subsurface at the site--including dry wells, drain fields, leaking underground storage tanks

2. _____Soil contamination that has been covered partially excavated and filled with at least 6 inches of clean soil

3. _____Soil contamination that has been covered or partially excavated and filled with less than 6 inches of clean soil

4. _____Uncontaminated soil cover >2 feet thick

5. _____No cover; or _____Cover <2 feet, but > 6" thick

6. _____Spill, discharge, or contaminated soil present at the surface in an area with maintained run-on/run-off control

7. _____Spill, discharge, or contaminated soil present at the surface in an area with unmaintained run-on/run-off controls?

8. _____Spill, discharge, or contaminated soil present at the surface with no run-on/run-off control or unknown controls?

9. _____Contaminated soil has been disturbed or excavated and stored above grade

10. _____A functioning vapor recovery system

11. _____No vapor recovery system

Additional comments/references:_____

_____

_____

_____

_____

_____

G. CONTAINMENT--SITE CHARACTERISTICS
(SW-11, SW-12, SW-13, SW-14; GW-12, GW-13; WK-5-9)

1. How would you evaluate the site soils? Circle predominant textural class.

_____ Sand, gravel, sandy gravel, well-graded sand, well-graded gravel, gravelly sand, gravelly sand loam, silty sandy loam?

_____ Poorly-graded sands with fines, silt-sand mixtures, loam, silt loam, sandy silt loam, clayey sand, clay sand loam?

_____ Clayey sands, sand-clay mixtures, clayey gravels, clay-sand-gravel mixtures, inorganic silts, clayey silt loam, silty clay loam, porous rock outcrop, sandy silty clay, sandy clay loam?

_____ Clay (organic and inorganic), clay loam, rock outcrop, peat, peaty clay?

Is the above based on personal observation, lab analysis, or professional judgement by a soil expert? (circle)

2. Total annual precipitation=_____in./yr (SW-11; WK-6)

3. Max. 2-yr/24-hr precip.=_____ inches (SW-12; WK-6)

4. Net precipitation (see 2.2, GW-12)=_____in. (WK-9)

5. Is the site not in a flood plain? _____(SW-12; WK-6)
Is the site in a 500 year flood plain? _____
Is the site in a 100 year flood plain? _____

6. What is the terrain slope to the nearest surface water?
_____% (SW-14; WK-6)

7. What is the subsurface hydraulic conductivity?
_____ cm/sec (GW-13; WK-9)

8. What is the vertical depth from the deepest point of known contamination to ground water?_____feet
(GW-13; WK-9)

Additional comments/references:_____
_____
_____
_____
_____

IV. Targets

A. DISTANCE TO SURFACE WATER (SW-15; WK-6)

1. What surface water(s) (lake, stream, river, pond, bay, etc.) is/are within 10,000 feet (downgradient) of the site?

Name	Dist.-ft.	Obs.	Meas.

None?_____.Comments/references:_____

2. What drinking water intakes are within 2 miles of the site? (all lake intakes, river intakes downstream only) (SW-15; WK-6)

None?_____

Source	Location	Pop. Served

3. How much acreage (anywhere) is irrigated by surface water intakes (downstream only) or wells(anywhere) within 2 miles of the site? (SW-15; GW-15; WK-6, WK-10)

None?_____

SURFACE WATER: Acres_____ (1600 acres max.)

Source(s)_____;

GROUNDWATER: Acres_____ (4500 acres max.)

Reference(s):_____

4. What is the distance to the nearest fishery resource (overland flow distance to nearest surface water which is a fishery resource)? (SW-16, SW-17, SW-18; WK-6)

   Over 10,000 feet?____ Distance if less than 10,000 feet?_____ft.

5. What are the names of, and the distances to, the nearest sensitive environments (total of overland distances plus downgradient distances, count only overland flow distance if nearest sensitive environment is a fishery)? (SW-18; A-15; WK-6)

   Over 10,000 feet?____ Names and distances if less than 10,000 feet:_____
   _____
   _____
   _____

6. Is the aquifer a federally-designated sole source aquifer?_____ (GW-14; WK-9)

7. Is the ground water used for: (GW-14; WK-10)
   _____ private supply
   _____ public supply
   _____ irrigation of human food crops or livestock
   _____ non-food (human) vegetation
   _____ not used due to natural contaminants
   _____ ground water not used, but usable

8. Distance to nearest drinking water well?_____feet (GW-15; WK-10)

9. Is there an alternate source available to groundwater for private or public water supply? (GW-14, WK-10)
   _____

10. Population served by drinking water wells within 2 miles?_____ (GW-115; WK-10)

11. Distance to the nearest population?_____feet (A-13,; WK-8)

12. Population within one-half mile radius?_____ (A-15; WK-8)

Additional comments (e.g. potential for natural resource damage, or other ecological concerns, references):_____
_____
_____
_____

APPENDIX C

WORKSHEET 1
SUMMARY SCORE SHEET

Site Name/Location (Street, City, County, Section/Township/Range, TCP ID Number):

Site Description (Include management areas, substances of concern, and quantities):

Special Considerations (Include limitations in site file data or data which cannot be accommodated in the model, but which are important in evaluating the risk associated with the site, or any other factor(s) over-riding a decision of no further action for the site):

ROUTE SCORES:

Surface Water/Human Health: _____ Surface Water/Environ.: _____

Air/Human Health: _____ Air/Environmental: _____

Ground Water/Human Health: _____

OVERALL RANK: _____

WORKSHEET 2
ROUTE DOCUMENTATION

1. SURFACE WATER ROUTE

List those substances to be considered for scoring: Source:____

Explain basis for choice of substance(s) to be used in scoring.

List those management units to be considered for scoring: Source:____

Explain basis for choice of unit to be used in scoring.

2. AIR ROUTE

List those substances to be considered for scoring: Source:____

Explain basis for choice of substance(s) to be used in scoring.

List those management units to be considered for scoring: Source:____

Explain basis for choice of unit to be used in scoring.

WORKSHEET 2 (CONTINUED)
ROUTE DOCUMENTATION

3. **GROUND WATER ROUTE**

List those substances to be considered for scoring: Source:____

Explain basis for choice of substance(s) to be used in scoring.

List those management units to be considered for scoring: Source:____

Explain basis for choice of unit to be used in scoring.

WORKSHEET 3 (If Required)
SUBSTANCE CHARACTERISTICS WORKSHEET
FOR MULTIPLE UNIT/SUBSTANCE SITES

Unit: | Combination 1 | Combination 2 | Combination 3 |

---

1. SURFACE WATER ROUTE

Substance(s):
Human Toxicity Value:
Environ. Toxicity Value:
Containment Value:
Rationale:

	Combination 1	Combination 2	Combination 3
Surface Water Human Subscore:	(+3)(+1)= ( )( ) = ___	(+3)(+1)= ( )( ) = ___	(+3)(+1)= ( )( ) = ___
Surface Water Environ. Subscore:	(+3)(+1)= ( )( ) = ___	(+3)(+1)= ( )( ) = ___	(+3)(+1)= ( )( ) = ___

---

2. AIR ROUTE

Substance(s):
Human Toxicity/Mobility Value:
Environ. Toxicity/ Mobility Value:
Containment Value:
Rationale:

	Combination 1	Combination 2	Combination 3
Air Human Subscore:	(+3)(+1)= ( )( ) = ___	(+3)(+1)= ( )( ) = ___	(+3)(+1)= ( )( ) = ___
Air Environ. Subscore:	(+3)(+1)= ( )( ) = ___	(+3)(+1)= ( )( ) = ___	(+3)(+1)= ( )( ) = ___

3. GROUND WATER ROUTE

Substance(s):
Human Toxicity Value:
Containment Value:
Rationale:

	Combination 1	Combination 2	Combination 3
Ground Water Subscore:	(+3)(+1)= ( )( ) = ___	(+3)(+1)= ( )( ) = ___	(+3)(+1)= ( )( ) = ___

Based on their respective highest scoring toxicity/containment combinations, the following management units will be used for route scoring:

Surface Water -
Air -
Ground Water -

WORKSHEET 4
SURFACE WATER ROUTE

1.0 SUBSTANCE CHARACTERISTICS

1.1 Human Toxicity

Substance	Drinking Water Standard (ug/l)	Val.	Acute Toxicity (mg/kg-bw)	Val.	Chronic Toxicity (mg/kg/day)	Val.	Carcino-genicity WOE	PF*	Val.
1. Arsenic									
2.									
3.									
4.									
5.									
6.									

*Potency Factor

Source:____
Highest Value:____ (Max.=10)

+2 Bonus Points?____
Final Toxicity Value____ (Max.=12)

1.2 Environmental Toxicity

( ) Freshwater
( ) Marine

Substance	Acute Water Quality Criteria (ug/l)	Value	Non-human Mammalian Acute Toxicity (mg/kg)	Value
1.				
2.				
3.				
4.				
5.				
6.				

Source:_____ **Value:**_____ (Max.=10)

1.3 Substance Quantity:_____ Source:_____ **Value:**_____ (Max.=10)

Explain basis:_____

WORKSHEET 4 (CONTINUED)
SURFACE WATER ROUTE

2.0 MIGRATION POTENTIAL

2.1 Containment — Source:_____ **Value:**_____ (Max.=10)
Explain basis:
_____

2.2 Surface Soil Permeability:_____ Source:_____ **Value:**_____ (Max.=7)

2.3 Total Annual Precipitation:_____ inches Source:_____ **Value:**_____ (Max.=5)

2.4 Max. 2-Yr/24-hour Precipitation:_____ inches Source:_____ **Value:**_____ (Max.=5)

2.5 Flood Plain:_____ Source:_____ **Value:**_____ (Max.=2)

2.6 Terrain Slope:_____ % Source:_____ **Value:**_____ (Max.=5)

3.0 TARGETS

3.1 Distance to Surface Water:_____ Source:_____ **Value:**_____ (Max.=10)

3.2 Population Served within 2 miles (See WARM Scoring Manual Regarding Direction): $\sqrt{}$pop.=$\sqrt{}$ = _____ Source:_____ **Value:**_____ (Max.=75)

3.3 Area Irrigated within 2 miles 0.75$\sqrt{}$no. acres=_____
(Refer to note in 3.2.): 0.75$\sqrt{}$ =0.75( )=_____ Source:_____ **Value:**_____ (Max.=30)

3.4 Distance to Nearest Fishery Resource:_____ Source:_____ **Value:**_____ (Max.=12)

3.5 Distance to, and Name(s) of, Nearest Sensitive Environment(s)_____ Source:_____ **Value:**_____ (Max.=12)
_____
_____
_____

4.0 RELEASE
Explain basis for scoring a release to surface water: Source:_____ **Value:**_____ (Max.=5)
_____
_____
_____

WORKSHEET 5
AIR ROUTE

1.0 SUBSTANCE CHARACTERISTICS

1.1 Introduction (WARM Scoring Manual) - Please review before scoring

1.2 Human Toxicity

Substance	Air Standard (ug/m^3)	Val.	Acute Toxicity (mg/m^3)	Val.	Chronic Toxicity (mg/kg/day)	Val.	Carcino-genicity WOE	PF*	Val.
1.									
2.									
3.									
4.									
5.									

*Potency Factor

Source:____
Highest Value:____ (Max.=10)

+2 Bonus Points?____
Final Toxicity Value:____ (Max.=12)

1.3 Mobility (Use numbers to refer to above listed substances)

1.3.1 Gaseous Mobility
Vapor Pressure(s) (mmHg): 1=____ ; 2=____ ; 3=____ ; 4=____ ; 5=____ ; 6=____ Source:____
Value:____ (Max.=4)

1.3.2 Particulate Mobility
Soil type:____ Source:____
Erodibility:____ Value:____ (Max.=4)
Climatic Factor:____

1.4 Highest Human Health Toxicity/Mobility Matrix Value (from Table A-7) equals **Final Matrix Value:**____ (Max.=24)

1.5 Environmental Toxicity/Mobility Source:____

Substance	Non-human Mammalian Acute Inhal. Toxicity (mg/m^3)	Value	Mobility (mmHg)	Value	(Table A-7) Matrix Value
1.					
2.					
3.					
4.					
5.					

Highest Environmental Toxicity/Mobility Matrix Value (From Table A-7) equals **Final Matrix Value:**____ (Max.=24)

WORKSHEET 5 (CONTINUED)
AIR ROUTE

1.6 Substance Quantity:_____ Source:_____ **Value:**____ (Max.=10)
Explain basis:_____
_____
_____
_____

2.0 MIGRATION POTENTIAL

2.1 Containment:_____ Source:_____ **Value:**____ (Max.=10)
_____
_____

3.0 TARGETS

3.1 Nearest Population:_____ Source:_____ **Value:**____ (Max.=10)

3.2 Distance to, and Name(s) of, Nearest Sensitive Environment(s)_____ Source:_____ **Value:**____ (Max.=7)
_____
_____
_____

3.3 Population within 0.5 miles: √pop.=√ =_____ Source:_____ **Value:**____ (Max.=75)

4.0 RELEASE

Explain basis for scoring a release to air:_____ Source:_____ **Value:**____ (Max.=5)
_____
_____
_____
_____

WORKSHEET 6
GROUND WATER ROUTE

1.0 SUBSTANCE CHARACTERISTICS

1.1 Human Toxicity

Substance	Drinking Water Standard (ug/l)	Val.	Acute Toxicity (mg/kg-bw)	Val.	Chronic Toxicity (mg/kg/day)	Val.	WOE	Carcino-genicity PF*	Val.
1.									
2.									
3.									
4.									
5.									
6.									

*Potency Factor

Source:____
Highest Value:____ (Max.=10)

+2 Bonus Points?____
Final Toxicity Value:____ (Max.=12)

1.2 Mobility (Use numbers to refer to above listed substances)
Cations/Anions: 1=___ ; 2=___ ; 3=___ ; 4=___ ; 5=___ ; 6=___. Source:____ **Value:**____ (Max.=3)

OR
Solubility(mg/l): 1=___ ; 2=___ ; 3=___ ; 4=___ ; 5=___ ; 6=___.

1.3 Substance Quantity:_____ Source:____ **Value:**____ (Max.=10)
Explain basis:_____

2.0 MIGRATION POTENTIAL

2.1 Containment Source:____ **Value:**____ (Max.=10)
Explain basis:_____

2.2 Net Precipitation:_____ inches Source:____ **Value:**____ (Max.=5)

2.3 Subsurface Hydraulic Conductivity:_____ Source:____ **Value:**____ (Max.=4)

2.4 Vertical Depth to Ground Water:_____ feet Source:____ **Value:**____ (Max.=8)

WORKSHEET 6 (CONTINUED)
GROUND WATER ROUTE

3.0 TARGETS

3.1 Ground Water Usage:_____ Source:_____ **Value:**____ (Max.=10)

3.2 Distance to Nearest Drinking Water Well:_____ft Source:_____ **Value:**____ (Max.=5)

3.3 Population Served within 2 Miles:√pop.=√____=_____ Source:_____ **Value:**____ (Max.=100)

3.4 Area Irrigated by (Groundwater) Wells within 2 miles: 0.75√no.acres=_____ Source:_____ **Value:**____ (Max.=50)
0.75√____=0.75 (____)=_____

4.0 RELEASE

Explain basis for scoring a release to ground water:_____ Source:_____ **Value:**____ (Max.=5)

_____

_____

_____

SOURCES USED IN SCORING

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

APPENDIX D

WASHINGTON RANKING METHOD

ROUTE SCORES SUMMARY AND RANKING CALCULATION SHEET

Site name: _____ Region: _____

Street, city, county: _____

Ecology TCP ID: _____

This site was ( ) ranked, ( ) re-ranked, on _____ based on quintile values from a total of ____ assessed/scored sites.

Pathway	Route Score(s)	Quintile Group number(s)
SW-HH	_____	_____
Air-HH	_____	_____
GW-HH	_____	_____
SW-En	_____	_____
Air-En	_____	_____

Priority scores:

$\frac{H^2 + 2M + L}{8}$ = _____

$\frac{H^2 + 2L}{7}$ = _____

Use the matrix presented to the right, along with the two priority scores, to determine the site ranking. N/A refers to where there is no applicable pathway (e.g. typically with ground water route-only sites).

Human Health \ Environment	5	4	3	2	1	N/A
5	1	1	1	1	1	1
4	1	2	2	2	3	2
3	1	2	3	4	4	3
2	2	3	4	4	5	3
1	2	3	4	5	5	5
N/A	3	4	5	5	5	NFA

DRAFT / FINAL

Matrix ("bin") Ranking: _____, or _____ No Further Action

CONFIDENCE LEVEL: The relative position of this site within this bin is:

_____almost into the next higher bin.
_____right in the middle, unlikely to ever change.
_____almost into the next lower bin.

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Rev. 06/28/96

UPDATE*UPDATE***UPDATE***UPDATE*UPDATE***UPDATE***UPDATE***UPDATE**

Pathway Score Ranges

The following ranges of pathway scores are the quintile breakdowns as of July 10, 1997 based on a total of 627 assessed sites. Slight changes to any, or all, of these ranges may occur in the future when additional sites are assessed/scored, and their applicable pathway scores added to their respective master list for ranking purposes. When sites are "de-listed" from Ecology's hazardous sites list their pathway scores will also be removed from the respective master lists. This may also result in minor alterations of these ranges.

Following the scoring of an appropriate number of sites with a sediment route, a quintile breakdown of sediment pathway score ranges will be made available.

I. Human health pathway scores

Quintile No.	Surface Water	Air	Ground Water
5	>27.9	>36.2	>56.3
4	21.6 - 27.9	22.7 - 36.2	45.6 - 56.3
3	15.4 - 21.5	15.1 - 22.6	37.3 - 45.5
2	7.2 - 15.3	8.1 - 15.0	28.7 - 37.2
1	<7.2	<8.1	<28.7

II. Environmental pathway scores

Quintile No.	Surface Water	Air
5	>52.8	>32.6
4	36.0 - 52.8	23.9 - 32.6
3	25.3 - 35.9	14.4 - 23.8
2	11.0 - 25.2	0.1 - 14.3
1	<11.0	<0.1

APPENDIX E

CANCELS: May 22, 1992 **PROCEDURE:** 320

APPROVED BY: Carol L. Fleshes

PRO 320 SITE HAZARD ASSESSMENT AND RANKING OF MODEL TOXICS CONTROL ACT (MTCA) SITES

ACTION BY:		ACTION:
Toxics Cleanup Program (TCP) Site Assessor (Hereafter referred to as Site Assessor)	1.	Prepares tentative list of high priority sites for site hazard assessments (SHAs), as identified for further follow-up actions.
	2.	Supplies tentative site list to Site Ranking Coordinator.
Site Ranking Coordinator	3.	Reviews list to screen out any MTCA sites which are also listed on the U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Responsibility, Compensation and Liability Information System (CERCLIS) List and are known to be high priority for current, or planned, investigative/ranking activities by EPA.
	4.	Notifies Site Assessor of those sites presently inappropriate for MTCA SHAs due to current or planned investigative/ranking activities by EPA.
Site Assessor	5.	Finalizes tentative SHA site list.
Regional Office/Cleanup/ Industrial Section Site Assessment Unit Leader (Hereafter referred to as Assessment Unit Leader)	6.	Reviews and approves final site list of upcoming SHAs.
Site Assessor	7.	Notifies owner/operator(s) of forthcoming SHAs, and requests recent site-specific information, as available.

	8.	Notifies Department of Health Hazardous Waste Section (DOH) of schedule of upcoming SHAs.
	9.	Notifies Site Register Coordinator of those sites designated as high priority SHAs.
Site Register Coordinator	10.	Publishes list of forthcoming high priority sites for SHAs in a Special Issue of the Site Register.
Site Assessor	11.	Gathers file information and other site-specific environmental data to begin compilation of SHA data collection summary sheets (SHADCSS), in preparation for site reconnaissances.
	12.	Prepares site-specific sampling and analysis plans (SAPs), and health and safety plans (HASPs), as appropriate.
	13.	Request contractor assistance, where required, following Ecology **Procedure PFM 310: Requesting a Contractor.**
Assessment Unit Leader	14.	Reviews and approves site-specific SAP(s) and HASP(s), as appropriate, for those SHAs conducted by Site Assessors.
Regional Office/Cleanup/ Industrial TCP Section Head	15.	Reviews site-specific work plans for sites where the scope of work and/or budget exceeds established TCP standard guidelines for SHAs.
	16.	Approves/disapproves work plan and/or budget variances.
	17.	Makes recommendation(s) to Assessment Unit Leader regarding variance(s) for SAP(s) and HASP(s).

Assessment Unit Leader	18.	Notifies Site Assessor of final recommendation(s)/approval of SAP(s) and HASP(s).
Site Assessor	19.	Submits Request for Analysis Forms to Manchester Laboratory, as required.
	20.	Conducts SHAs, along with DOH representative(s), and Site Ranking Coordinator, as required.
Site Ranking Coordinator	21.	Participates in SHAs during each six-month series where assistance is required.
Site Assessor	22.	Completes SHADCSS, with all references documented, as appropriate.
	23.	Makes a decision of No Further Action (NFA) for any sites, as applicable.
	24.	Completes Scoring Worksheets 1-6 for each assessed site which is to be ranked.
	25.	Calculates migration pathway scores, as applicable.
	26.	Completes Summary Scoresheets for all assessed/scored sites.
	27.	Notifies TCP Natural Resource Damage Assessment (NRDA) Coordinator of those sites with a potential for natural resource damage.
Site Ranking Coordinator	28.	Reviews all new scoring packages for consistency and accuracy in application of the Washington Ranking Method (WARM) Scoring Manual.
	29.	Finalizes all new pathway scores, with concurrence of Site Assessor.

30. Adds all newly finalized pathway scores to their respective cumulative master pathway lists and re-establishes quintile groupings in accordance with procedures described in Chapter 7 of the SHA Guidance and Procedures for WARM manual.

31. Calculates Human Health Priority and Environmental Priority values using the quintile values obtained for all applicable pathways for each site.

32. Obtains rank of each site through using priority values and the ranking matrix in the WARM Scoring Manual.

33. Supplies lists of newly ranked sites to all Site Assessors.

Site Assessor

34. Circulates lists of newly ranked NFA sites to Assessment Unit Leaders, Site Managers, and any other appropriate regional staff, for concurrence on all site rankings.

35. Notifies the Site Ranking Coordinator and Site Register Coordinator of final site rankings, and NFA sites.

36. Supplies Site Ranking Coordinator with two copies of finalized scoring packages, and SHADCSS, if completed, for each newly ranked site.

37. Notifies site owners/operators of their site's ranking, or NFA status, at least two weeks prior to publication of the Site Register (at least four weeks for publically owned sites).

38. Repeats Actions numbered 1 through 9 (above) to generate a new final list of forthcoming high priority SHAs to be published in the Special Issue

of the Site Register, along with the rankings of the newly assessed and scored sites.

Site Register Coordinator

39. Publishes names and rankings of newly assessed and ranked sites, and NFA sites, in the Special Issue of the Site Register, along with a listing of high priority sites for forthcoming SHAs.

Site Ranking Coordinator

40. Supplies copies of summary scoring sheets for all newly assessed and ranked sites to the TCP Public Information Officer prior to the publication date of the Special Issue of the Site Register.

41. Supplies a listing of the newly assessed sites, and their rankings, to EPA Region X prior to publication in the Special Issue of the Site Register.

42. Supplies copies of scoring packages, and SHADCSS, as available, for all newly assessed and ranked sites to the DOH.