9285.9-25

Hazard Ranking System Training

Winter 1994

US Environmental Protection Agency
Hazardous Site Evaluation Division
Site Assessment Branch

Foreword

The primary purpose of the Hazard Ranking System (HRS) training course is to provide participants with the knowledge and tools needed to effectively use the HRS. The basic training materials used in the HRS training course are the HRS rule and *The Hazard Ranking System Guidance Manual*. The course materials contained in this booklet are meant to complement, but not substitute for, these basic references.

This training course is designed to:

- serve as an introduction into the HRS rule and provide a roadmap to *The Hazard Ranking System Guidance Manual*,

- provide an interactive learning experience for participants through specifically-designed exercises, and

- show how the HRS defines what has to be observed, measured, sampled, and reported at the site inspection.

When you complete this course, we expect that you will understand the HRS rule and be able to use *The Hazard Ranking System Guidance Manual* to resolve questions that may arise in the design and implementation of the site inspection or in the compilation of an HRS package.

This training course is divided into 20 sections that are linked to the major chapters and sections in *The Hazard Ranking System Guidance Manual*. The exercises have been designed to reinforce key concepts.

Table of Contents

HRS Training Course Agenda

DAY 1--Morning: 8:00 AM

Duration

0:45	Video: "Site Assessment Screening: A National Priority."
0:15	EPA Introduction.
0:20	Section 1: Introduction, the Site Assessment Process.
0:20	Break.
0:20	Section 2: Regulatory Context of the HRS.
0:30	Section 3: HRS Structure.
1:00	Introduction to LPQ Auto Parts.
0:30	Section 4: Source Characterization
1:00	Lunch

DAY 1--Afternoon: 1:00 PM

Duration

1:00	Section 5: Waste Characteristics.
1:00	Exercise 1: Characterization of Sources.
0:20	Break.
0:40	Section 6: Observed Release.
1:00	Exercise 2: Observed Release to Surface Water.

DAY 2--Morning: 8:00 AM

Duration

0:30	Section 7: Actual Contamination.
0:20	Exercise 3: Actual Contamination of Targets.
1:15	Section 8: Sampling and Data Quality.
0:20	Break.
1:15	Section 9: Ground Water Pathway - Likelihood of Release.
0:45	Exercise 4: Ground Water Potential to Release to the Chagrin Aquifer.
1:00	Lunch.

DAY 2--Afternoon: 1:00 PM

Duration

0:45	Section 10: Ground Water Pathway - Waste Characteristics and Targets.
1:30	Exercise 5: Ground Water Pathway - Glacial Aquifer.
0:20	Break.
1:15	Section 11: Surface Water Pathway - Likelihood of Release.

HRS Training Course Agenda (Continued)

DAY 3--Morning: 8:00 AM

Duration

0:30	Exercise 6:	Surface Water Pathway - Potential to Release.
0:40	Section 12:	Surface Water Pathway - Drinking Water Threat.
0:20	Break.	
1:15	Section 13:	Surface Water Pathway - Human Food Chain Threat.
0:30	Exercise 7:	Surface Water Pathway - Human Food Chain Threat.
0:45	Section 14:	Surface Water Pathway - Environmental Threat.
1:00	Lunch	

DAY 3--Afternoon: 1:00

Duration

0:50	Exercise 8:	Surface Water Pathway - Environmental Threat.
0:25	Section 15:	Surface Water Pathway - Ground Water to Surface Water Component.
0:20	Break.	
1:00	Section 16:	Air Pathway - Likelihood of Release.
0:45	Exercise 9:	Air Pathway - Potential to Release.
0:40	Section 17:	Air Pathway - Waste Characteristics and Targets.

DAY 4--Morning: 8:00 AM

Duration

1:00	Exercise 10:	Air Pathway - Targets.
0:45	Section 18:	Soil Exposure Pathway - Resident Population Threat.
0:20	Break.	
1:00	Exercise 11:	Soil Exposure Pathway - Resident Population Threat.
0:20	Section 19:	Soil Exposure Pathway - Nearby Population Threat.
0:20	Break.	
0:45	Exercise 12:	Soil Exposure Pathway - Nearby Population Threat.
0:20	Section 20:	Radionuclides.
0:15	Exercise 13:	Calculation of the Site Score for LPQ Auto Parts.

Section 1

Introduction

Course Objectives

- To learn how to use the HRS rule, the HRS Guidance Manual, the Superfund Chemical Data Matrix (SCDM), and other site assessment guidance documents.

- To understand how HRS defines the type and quality of information that must be gathered during the site inspection (SI).

The Site Assessment Process

Please turn to the HRS Guidance Manual, page 3, highlight 1-1.

The Preliminary Assessment

- The Preliminary Assessment (PA) is a low-cost review of available information used to determine if the site warrants further investigation.

- No samples are taken.

- The PA method parallels the HRS, but uses environmentally conservative simplifications in the absence of data.

- These PA simplifications may result in a relatively high "false alarm" rate.

- If the PA score is 28.50 or greater, a Site Inspection (SI) will be scheduled.

- If the PA score is under 28.50, the site is listed as "No Further Response Action Planned" (NFRAP).

The Site Inspection

- The Site Inspection (SI) builds on the data gathered at the PA, tests the hypotheses that were developed, and challenges the simplifying assumptions made at the PA.

- Limited samples may be taken during the SI to characterize wastes, estimate the extent of contamination, and determine if hazardous substances have migrated into the media of concern.

- The limited budget of the SI requires careful scoping of a strategy that is driven by the information needs of the HRS.

- Information from the SI feeds into the HRS scoring.

- If the SI score is 28.50 or greater, the site is scored formally using the HRS and an HRS package may be prepared to document the final HRS score.

The Hazard Ranking System

- The Hazard Ranking System (HRS) is the scoring system EPA uses to assess the relative threat associated with the release or potential release of hazardous substances from a site.

- The HRS is a simple, numerically based scoring system that uses information obtained from the initial, limited investigations conducted at the site: the PA and SI.

- The HRS is a screening tool and not a risk assessment.

- The HRS score is the primary criterion EPA uses to determine whether a site should be placed on the National Priorities List (NPL).

- NPL listing informs the public that the site appears to present sufficient relative risk to warrant the more extensive site characterization of a remedial investigation and risk assessment.

Section 2

Regulatory Context of the HRS

CERCLA

- CERCLA, referred to as "Superfund," was passed in 1980 to fill a gap in the nation's environmental laws (highlighted by Love Canal, NY).

- CERCLA established a $1.6 billion trust fund for 5 years to fund:

  - removal actions (short-term responses).
  - remedial actions (long-term responses).
  - legal enforcement actions.

- CERCLA also required the establishment of a National Priorities List (NPL) of the releases of hazardous substances that present the greatest threats to public health and the environment.

  - CERCLA restricts the use of remedial action funds to NPL sites.

The Hazard Ranking System

- The HRS was established in 1982 to rank hazardous waste sites so that the most serious could be included on the NPL.

- A cutoff score of 28.50 was established for listing on the NPL.

  - This score was set to meet the Congressional mandate of 400 sites on the original NPL.

  - This score appears to flag 5 to 10 percent of all sites as NPL sites.

SARA

- The Superfund Amendments and Reauthorization Act (SARA) of 1986 extended and increased the CERCLA trust fund.
  - Funded at $11.97 billion through 1994.
- SARA also required EPA to revise the HRS:
  - "... shall ensure, to the maximum extent feasible, that the hazard ranking system accurately assesses the relative degree of risk to human health and the environment posed by sites and facilities subject to review."
- The revised HRS was promulgated in 1990 (the one currently used).
- The next Superfund reauthorization is underway, in 1994.

Hazardous Substances

- CERCLA hazardous substances are defined by reference to other laws in CERCLA §101(14).
    - The list of over 600 CERCLA hazardous substances is provided in 40 CFR 302.4.
- CERCLA pollutant or contaminants are defined in terms of their negative impact on people and the environment in CERCLA §101(33).
    - These negative impacts must be documented if a pollutant or contaminant is used for HRS scoring.

Please turn to the HRS Guidance Manual, page 18.

Hazardous Substances (Concluded)

- The HRS definition of hazardous substance includes both CERCLA hazardous substances and "pollutants or contaminants".

Please turn to the HRS rule,
page 51586.

HRS Definitions of Site and Source

- HRS definition of site and source:

Please turn to the HRS rule,
page 51587.

- EPA evaluates sources with the HRS, but lists sites on the NPL.

CERCLA Definition of Release

- **CERCLA definition of release:**
  - **Release: CERCLA §101(22).**

    "[A]ny spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles containing any hazardous substance or pollutant or contaminant)..."

Petroleum Exclusion

- "Petroleum, natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel" are excluded from consideration under CERCLA.

- The petroleum exclusion includes the substances found in products coming out of a refinery, including gasoline with additives such as 1,2-dichloroethene and lead tetraethyl.

Please turn to the HRS Guidance Manual, page 19.

- Whenever it is suspected that the petroleum exclusion may apply to a site, consult the regional NPL coordinator.

Radioactive Materials

- A limited category of radioactive materials are excluded from CERCLA consideration.

  - Releases from a nuclear power plant licensed by the Nuclear Regulatory Commission (NRC) and covered under NRC financial and liability provisions.

  - Releases from one of 17 uranium tailings sites specifically designated in the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA).

Please turn to the HRS Guidance Manual, page 19.

Other Excluded Releases

- Certain releases are excluded from response by CERCLA statute, even though they may involve a CERCLA hazardous substance, pollutant, or contaminant. These include:

  - releases that result in exposure solely within the workplace.

  - emissions from engine exhaust of a motor vehicle, train, aircraft, vessel, or power pumping station.

  - the normal application of fertilizer.

Policy Considerations in Listing Sites

- Historically, the listing of certain types of sites, although eligible for scoring, has raised policy issues for EPA. These types of sites should be discussed with regional NPL coordinators.

  - RCRA Subtitle C treatment, storage, or disposal facilities.

  - Facilities with a current license issued by the NRC.

  - Environmental problems that have resulted from the legal application of pesticides permitted under the Federal Insecticide, Fungicide and Rodenticide Act.

  - Ground water plumes or contaminated surface water sediments where the source is currently unknown. Such sources could, for instance, be subject to RCRA Subtitle C and deferred to that authority.

Introduction to Guidance Materials

Please turn to the HRS Guidance Manual,
page 8, highlight 1-3.

- HRS rule: 40 CFR 300, appendix A
- HRS issues resolutions (also called preliminary resolutions).
- WordPerfect file: electronic documentation record format

Section 3

HRS Structure

The Pathways

- An HRS score for a site is determined by evaluating four pathways.

  - Ground water migration pathway.

  - Surface water migration pathway.
    - Drinking water threat.
    - Human food chain threat.
    - Environmental threat.

  - Soil exposure pathway.
    - Resident population threat.
    - Nearby population threat.

  - Air migration pathway.

Site Score

- The scores of the four pathways (0 to 100) are combined by a root mean square method to give a single site score (0 to 100).

Please turn to the HRS rule, section 2.1.1, page 51587.

  - This method puts emphasis on the highest scoring pathway.
  - If one pathway "maxes out" at 100, the site score is 50.00. If a second pathway has a score of 10, the site score rises to 50.25.

Please turn to the HRS Guidance Manual, page 31.

Pathway Scores

- Each pathway score is based on the product of three "factor categories" that are multiplied and normalized to a pathway score of 0 to 100.

$$\frac{\text{likelihood of release x waste characteristics x targets}}{82{,}500}$$

- The scaling factor of 82,500 results in a pathway score of 100 when the factor category values for likelihood of release and waste characteristics are at their "typical" maximum norm and the targets factor category value is 150 [i.e., (550 x 100 x 150)/82,500 = 100].

Pathway Scores (Concluded)

Please turn to the HRS rule,
table 2-1, page 51587.

Likelihood of Release

LR x WC x T

Observed Release

Potential to Release

Likelihood of Release (Continued)

- Likelihood of release has the same structure for all three migration pathways.
- Either an observed release is documented or the potential to release factors are evaluated.
- An observed release is assigned the maximum value for likelihood of release (550 points).

Likelihood of Release (Continued)

- If an observed release cannot be documented, then the potential to release factors are evaluated.

- Potential to release is assigned a value of between 0 to 500 points and is the product of:

  — source containment of hazardous substances against release to the media being evaluated (ground water, surface water, air) multiplied by

  — media-specific factors that facilitate migration of the hazardous substances, once containment is lost.

Likelihood of Release (Concluded)

Please turn to the HRS rule,
table 3-1, page 51595.

Please turn to the HRS rule,
table 3-2, page 51596.

Waste Characteristics

$$LR \times WC \times T$$

Most Hazardous Substance

Hazardous Waste Quantity

Waste Characteristics (Concluded)

Please turn to the HRS rule,
table 3-1, page 51595.

- The waste characteristics factor category evaluates how much waste is at the site and how hazardous it is.

- The waste characteristics factor category is calculated based on hazardous waste quantity and pathway-specific factors (e.g., toxicity, mobility, persistence) that characterize the single most hazardous substance present at the site.

Targets

LR x WC x T

Actual Contamination

Potential Contamination

Level I

Level II

Targets (Concluded)

Please turn to the HRS rule, table 2-1, page 51587.

- Four types of targets are evaluated in each pathway:
  - Nearest individual.
  - Population.
  - Resources.
  - Sensitive Environments.
- The targets factor category is not capped. The score for targets can go as high as site conditions warrant.

HRS Structure

- One site score.
- Four pathway scores.
- Three factor category values per pathway.
- Several factor values per factor category.
- The HRS is simply a set of rules for assigning values to factors, factor categories, pathway scores, and the site score.

LPQ Auto Parts

Pathway	Rating (1 to 5)	Rationale
Ground Water		
Surface Water		
Soil Exposure		
Air		

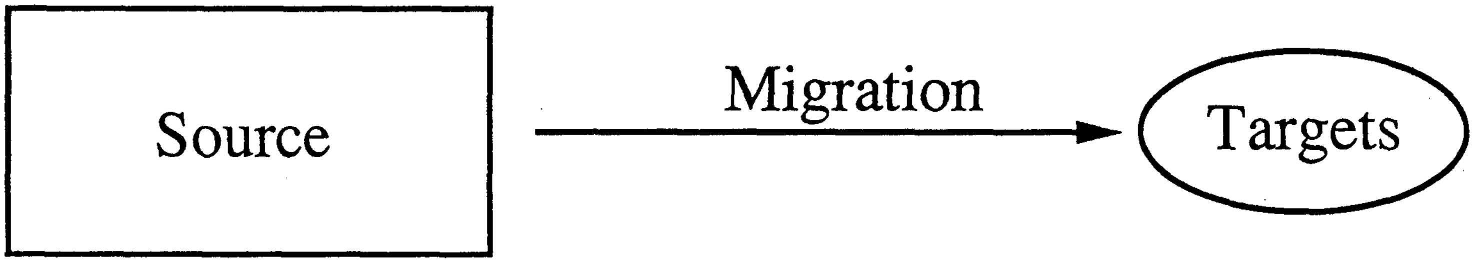
Section 4

Source Characterization

What is a Source?

Please turn to the HRS rule, section 1.1, page 51587.

Migration Pathways:



Source Characterization

- A complete source characterization should evaluate;
  - source type,
  - source boundaries,
  - identification of hazardous substances,
  - containment, and
  - waste characteristics (hazardous waste quantity and substance-specific characteristics).

Source Type

- Identify the type of source you are evaluating, using the HRS categories as your guide.

Please turn to the HRS Guidance Manual, page 42.

- Sources are evaluated only in the three migration pathways. In the soil exposure pathway, areas of observed contamination are evaluated.

Source Boundaries

- Identify sources and define source boundaries using;
  - visual observations during the site visit,
  - historical records,
  - sampling results,
  - aerial photographs, and/or
  - interviews with individuals having knowledge of the site.
- Accuracy in identifying sources and their boundaries becomes crucial when evaluating distances to targets.

Identification of Hazardous Substances

- Determine the hazardous substances, pollutants, and contaminants associated with each source.

- Hazardous substances, pollutants, and contaminants associated with a source can be identified using;

  - sampling data,
  - PRP records, labels, and manifests,
  - State or Federal records and permits,
  - information on site operations, and/or
  - historical records.

- All hazardous substances associated with each source (with non-zero containment) should be identified.

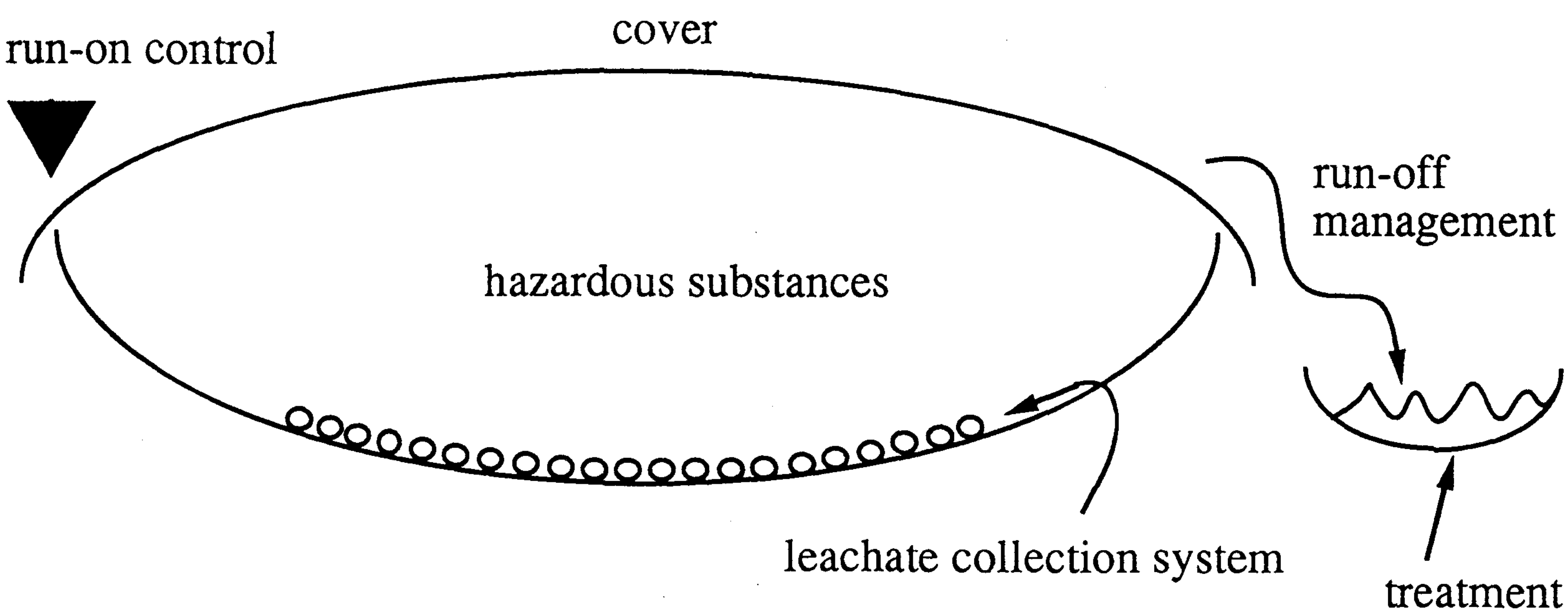
Containment

- Containment is specific to the pathway being evaluated.
- Specific containment features must be observed and reported if the HRS is to be properly applied.

Please turn to the HRS rule,
table 3-2, page 51596.

Containment (Concluded)

Please turn to the HRS Guidance Manual, page 147.



Section 5

Waste Characteristics

Waste Characteristics Factor Category

LR x WC x T

Most Hazardous Substance

Hazardous Waste Quantity

Waste Characteristics Factor Category (Concluded)

- The waste characteristics factor category evaluates the following two factors for all pathways;
  - hazardous waste quantity, and
  - toxicity (human or environmental).
- In addition, the following factors are evaluated for specific pathways and threats;
  - mobility,
  - persistence,
  - bioaccumulation potential, and
  - ecosystem bioaccumulation potential.

Substance-Specific Factors

- The most hazardous substance is the substance with the highest product for the following pathway-specific factor values.

Ground Water	Tox.	x	GW Mob.		
Surface Water					
Drinking Water	Tox.	x	Persist.		
Human Food Chain	Tox.	x	Persist.	x	Bioacc. (FC)
Environmental	EcoTox.	x	Persist.	x	Bioacc. (EN)
GW to SW	Add GW mobility to the above.				
Soil Exposure	Tox.				
Air	Tox.	x	Air Mob.		

Substance-Specific Factors (Concluded)

Please turn to the HRS rule,
section 2.4.1, page 51589.

Please turn to the LPQ SI report,
reference 2, page 38.

Hazardous Waste Quantity

- For each source, document hazardous waste quantity using the following four measures in the following hierarchy:

  - Hazardous constituent quantity (tier A).
  - Hazardous wastestream quantity (tier B).
  - Volume (tier C).
  - Area (tier D).

- In the HRS evaluation of a source, move down through the tiers, assigning values for the information that is available.

  - At whatever tier the information is reasonably complete and accurate, stop.

- For each source, the highest value of tiers A-D is selected as the source hazardous waste quantity value.

HRS Table 2-5

- The hazardous waste quantity factor is based on the quantity of hazardous substances at the site.

Please turn to the HRS rule,
table 2-5, page 51591.

Tier A: Hazardous Constituent Quantity

- Tier A is used when data are available on the quantities of individual CERCLA hazardous substances.
- Tier A includes only the pounds of pure CERCLA hazardous substances, not the mass of pollutants or contaminants.

Please turn to the HRS Guidance Manual, page 91.

- If tier A for the source is "adequately determined" assign a zero to tiers B-D.
- If tier A cannot be adequately determined, assign a tier A value based on available information, and proceed to tier B.

Tier B: Hazardous Wastestream Quantity

- Tier B is based on the wastestreams that went into the source, not on its capacity or volume.

- Tier B not only includes CERCLA hazardous substances but also pollutants and contaminants and the associated waste material that contains the hazardous substances.

  - The materials must be commingled at the time of deposition.

Please turn to the HRS Guidance Manual, page 99.

- If tier B for the source is "adequately determined" assign a zero to tiers C-D.

- If tier B cannot be adequately determined, assign a tier B value based on available information, and proceed to tier C.

Tier C: Volume

- Tier C is based on the capacity, not the actual contents of the source.
- Estimate the volume measure using the dimensions of the source.

Please turn to the HRS Guidance Manual, page 105.

- If tier C can be determined for a source, assign a value of 0 to tier D.
- If tier C cannot be determined, assign a value of 0 to tier C and move on to tier D.

Tier D: Area

- Tier D assumes a default depth for each source. Do not evaluate tier D if the actual depth of the source is known (evaluate tier C instead).

Please turn to the HRS Guidance Manual, page 109.

Hazardous Waste Quantity Calculation

- For each source at the site, evaluate all appropriate tiers and make a list of the value(s) for each tier, and select the highest tier value as the source hazardous waste quantity value.
  - In the SI report, provide all available documentation for all tiers for all sources.
- For the site, sum the source hazardous waste quantity values.
  - If a source has a 0 (zero) value for containment for the pathway being evaluated, drop that source from the sum.

Please turn to the HRS Guidance Manual, page 112, highlight 6-9.

Minimum Factor Values

- If tier A is not adequately determined for all sources, then the hazardous waste quantity factor value for the pathway is subject to a minimum value.

- The minimum factor value is applied to compensate for a low hazardous waste quantity value due to a lack of waste information about the sources.

Please turn to the HRS rule,
table 2-6, page 51591.

Minimum Factor Values (Concluded)

- If tier A is not adequately determined for all sources, and the value from table 2-6 is a 1, a minimum alternative value applies:
  - for the soil exposure pathway, HWQ = 10.
  - for the migration pathways, HWQ = 10 or 100.
- Two situations can raise the minimum alternative value to 100:
  - a target in the pathway is subject to level I or level II.
  - a qualifying removal has taken place and the quantity before the removal was 100 or greater.

Waste Characteristics

Please turn to the HRS rule,
section 2.4.3, page 51592.

Waste Characteristics (Concluded)

- Example: ground water pathway.

  The most hazardous substance at the site for the ground water pathway is arsenic:

— Toxicity:	10,000	(from SCDM)
— Mobility:	1	(from SCDM)

  Multiply toxicity x mobility = 10,000

- The hazardous waste quantity factor value is 100 (table 2-6).

  Multiply toxicity/mobility factor value x
  hazardous waste quantity factor value = 1,000,000.

- Waste characteristics factor value = 32 (table 2-7).

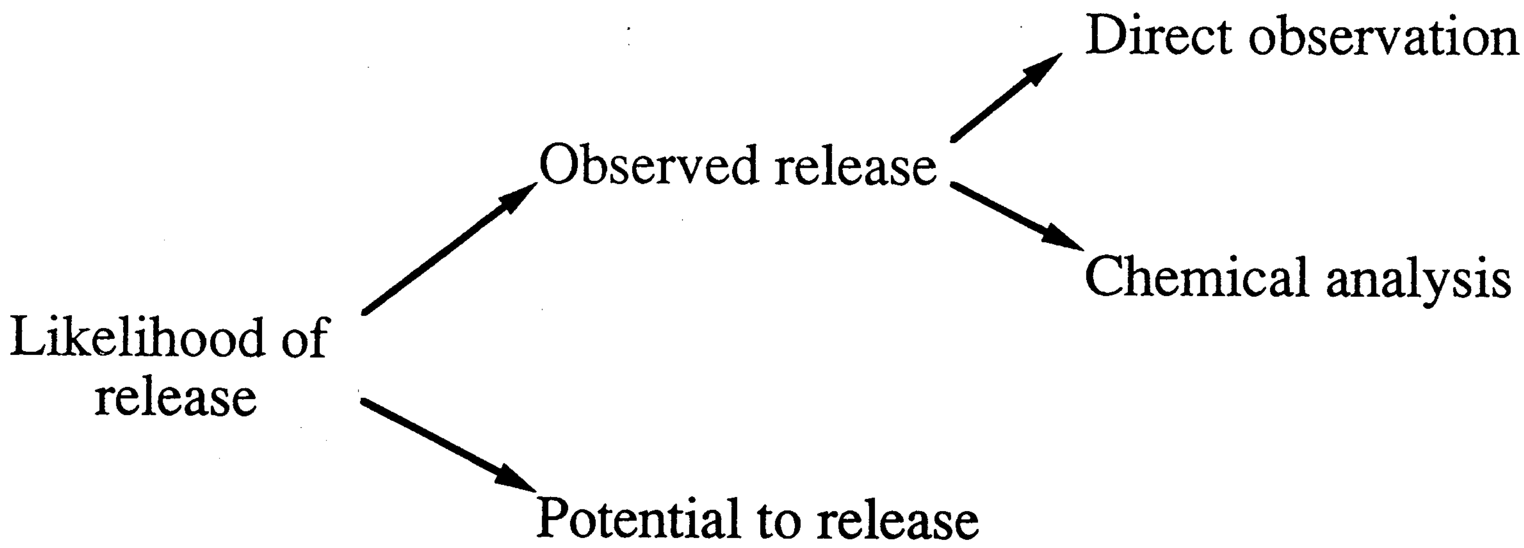
Exercise 1

Please turn to the Student Exercises, Exercise 1.

Section 6

Observed Release

Likelihood of Release



Observed Release

- An observed release means that:
  - hazardous substances have been documented to have entered the media of concern, and
  - the release is attributable, at least in part, to the site that is being evaluated.
- Definition of attribution:

Please turn to the HRS Guidance Manual, page 55.

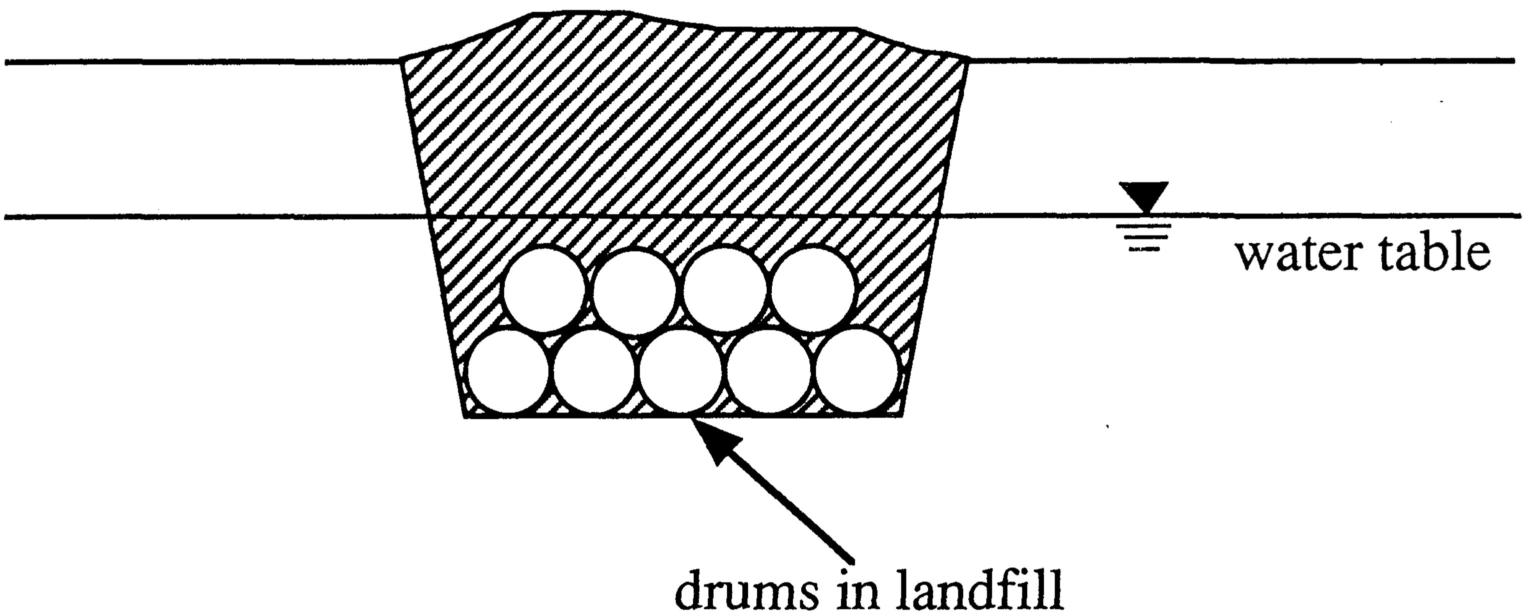
Observed Release by Direct Observation

- A hazardous substance is observed to have been released into the media of concern.

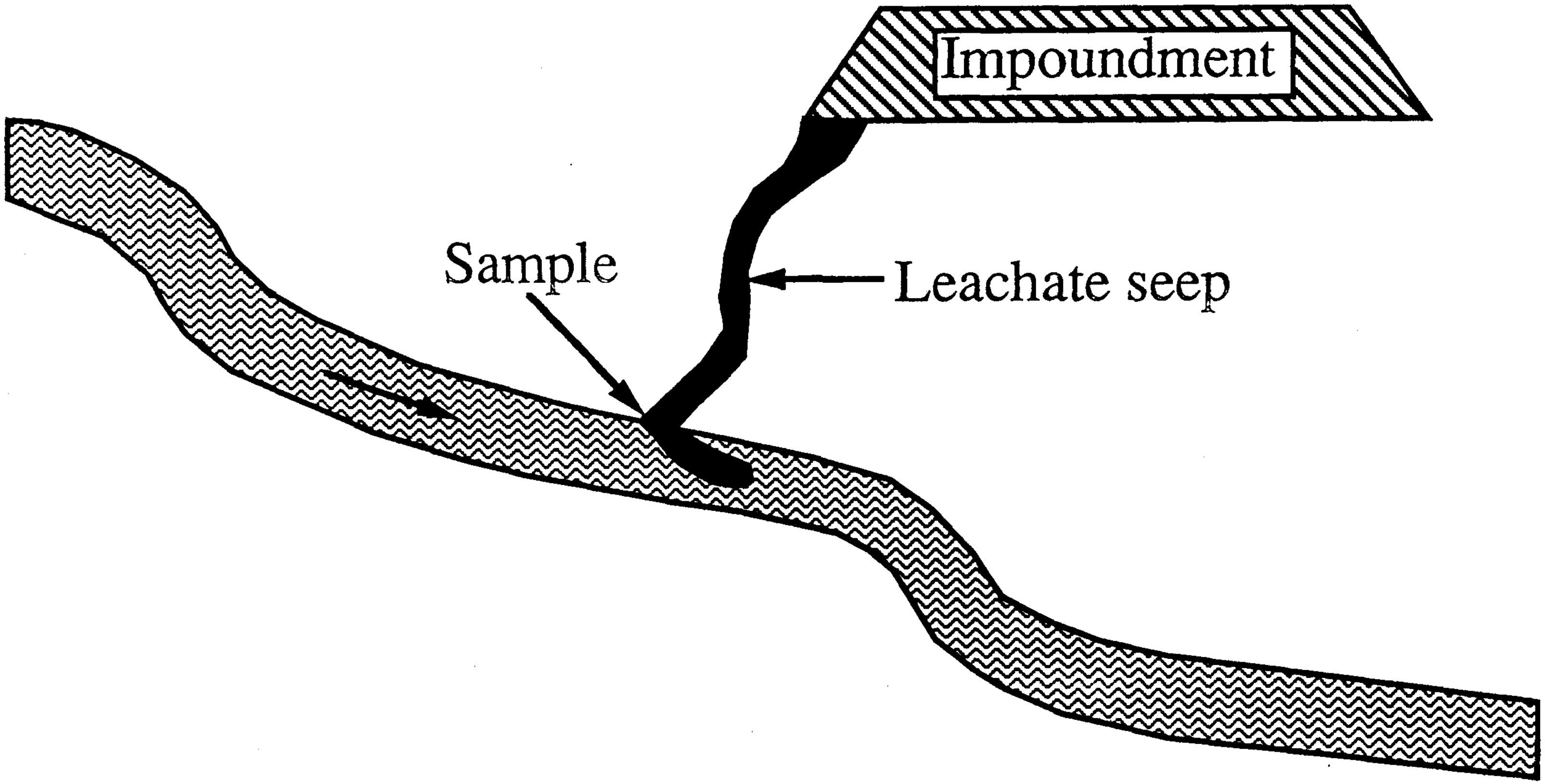
- Documentation must substantiate that a hazardous substance was present in the materials observed to have been released.

- An observed release by direct observation can not be evaluated for the soil exposure pathway. Chemical analysis of samples is required.

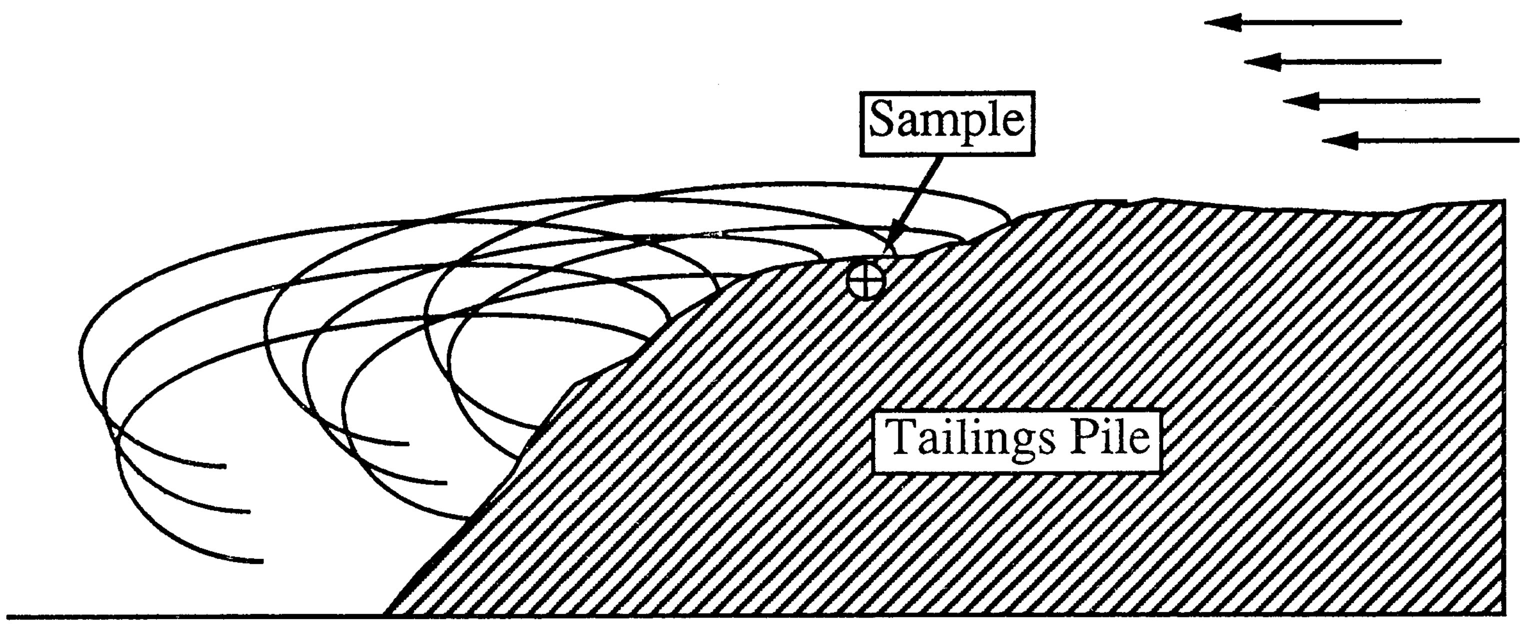
Observed Release by Direct Observation - Ground Water Pathway



Observed Release by Direct Observation - Surface Water Pathway



Observed Release by Direct Observation - Air Pathway



Observed Release by Chemical Analysis

- One or more analytical samples from the media show contamination significantly above the background level for the media.

  - Generally, one reliable release sample is all that has been required even if earlier, or later, sampling fails to show a release.

  - Statistical analysis across samples or across time is not required.

- Some portions of the release must be attributable to one or more sources at the site.

- The release should not be from site disturbance caused by the sampling team.

Significance Above Background

Please turn to the HRS rule,
table 2-3, page 51589.

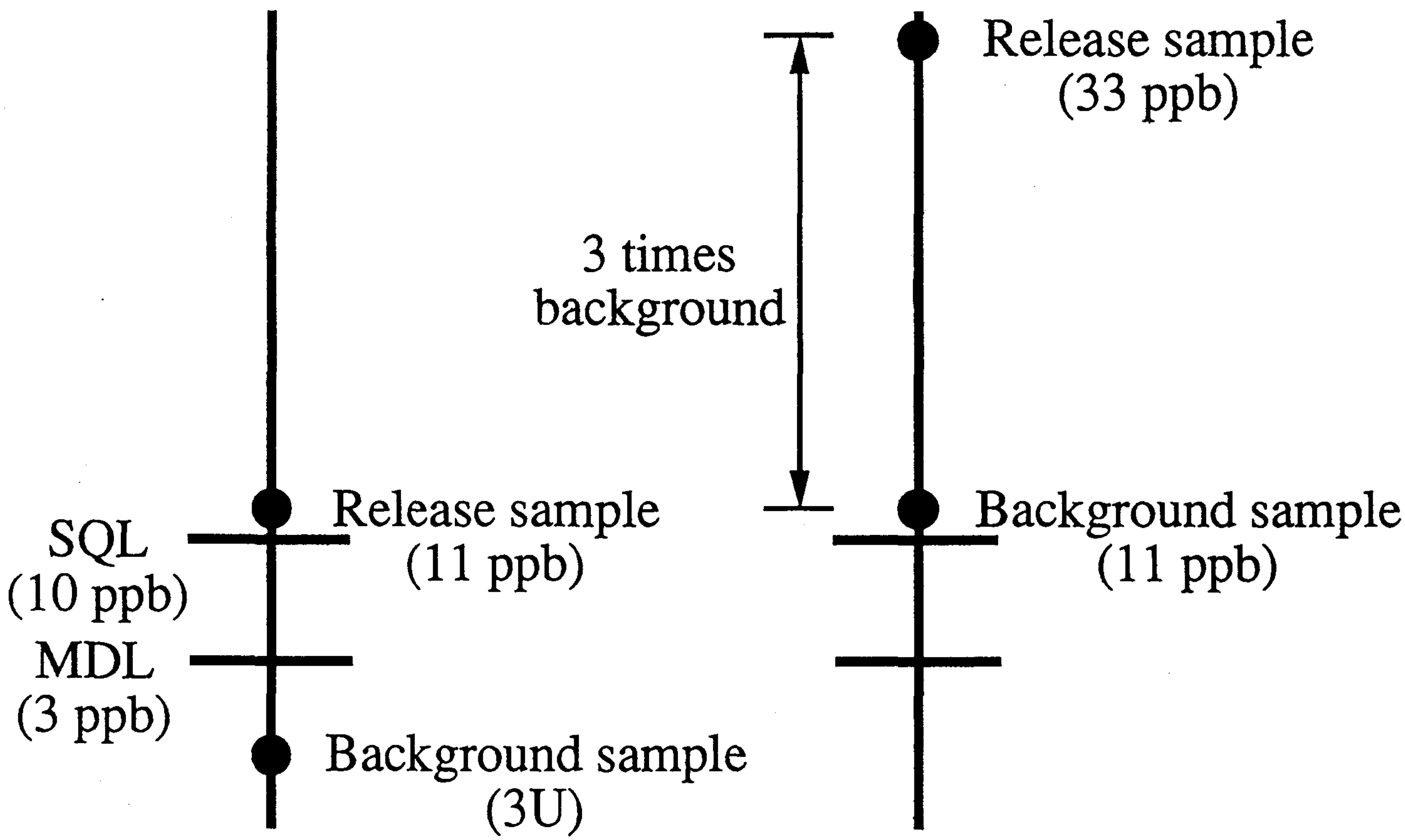
- If the background is non-detect, then the sample measurement must equal or exceed the sample quantitation limit (SQL).

  - If the SQL cannot be established and the sample was analyzed under CLP, use the CRQL or the CRDL.
  - If the SQL cannot be established and the sample was not analyzed under CLP, use the DL for the method (MDL).

- If the background is detected, then the sample measurement must be at least three times above the background concentration.

  - The "at least three times above background" rule is a minimum standard that gives protection against false positives in the laboratory.

Significance Above Background (Concluded)



Background

- **Definition of background:**

Please turn to the HRS Guidance Manual, page 67.

- **Background samples are the usual way, but not the only way, to establish the background levels of substances in environmental media.**

Noisy Background

- Background samples do not have to be "clean" or non-detect.
- Sometimes the background for a substance is "noisy" (that is, the background samples show contamination).
- Examples:
  - Metals in soil sediments.
  - Trichloroethene in urban surficial aquifers.
  - Rivers in heavily industrial areas.
- It is not necessary to establish that the site being evaluated is the only source of contamination, but that the site has significantly increased the level of contamination compared to background.

Selecting Appropriate Background Samples

- When background is established by chemical analysis, the background and release sample must be similar. For example:
  - Filtered versus unfiltered ground water samples.
  - Depths of ground water samples within an aquifer (floaters versus sinkers).
  - Different soil horizons.
  - Different regimes within a stream.
  - Sediment samples versus aqueous samples.
  - Tissue samples (age, species).
  - Date of sampling.

Establishing Background Levels Without Sampling

- The HRS does not require a background sample to establish a background level.
- At some sites, it may not be possible to collect samples to determine a background level.
- At these sites, it may be necessary to establish the background level based on published data relevant to the site.

Please turn to the HRS Guidance Manual, page 62.

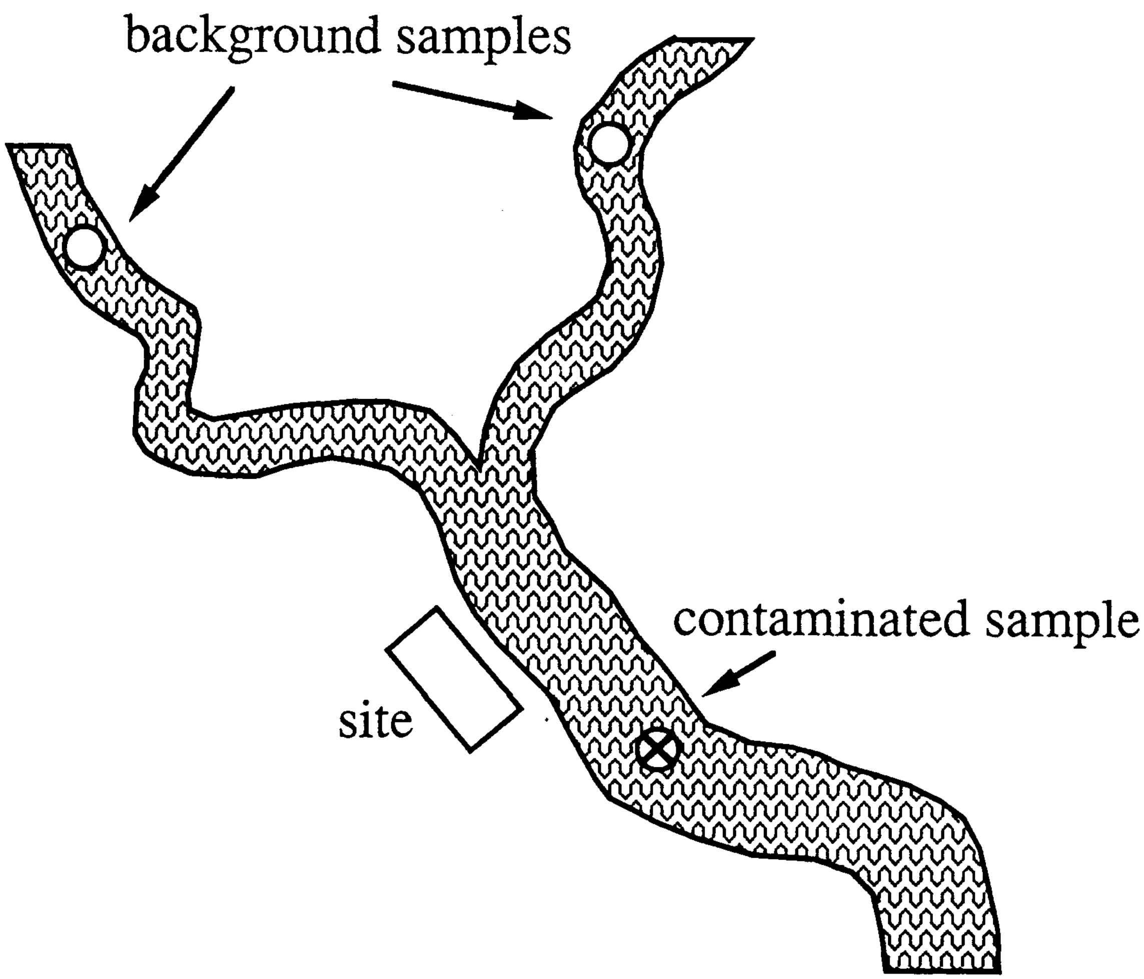
Attribution

- Background samples are often required to establish attribution versus alternative sources.
  - Place the background sample so as to include the contribution of the alternative source to the contamination level in the vicinity of the site.
  - Demonstrate that the release sample is significantly elevated above background, including the contribution of the alternative source to that background.

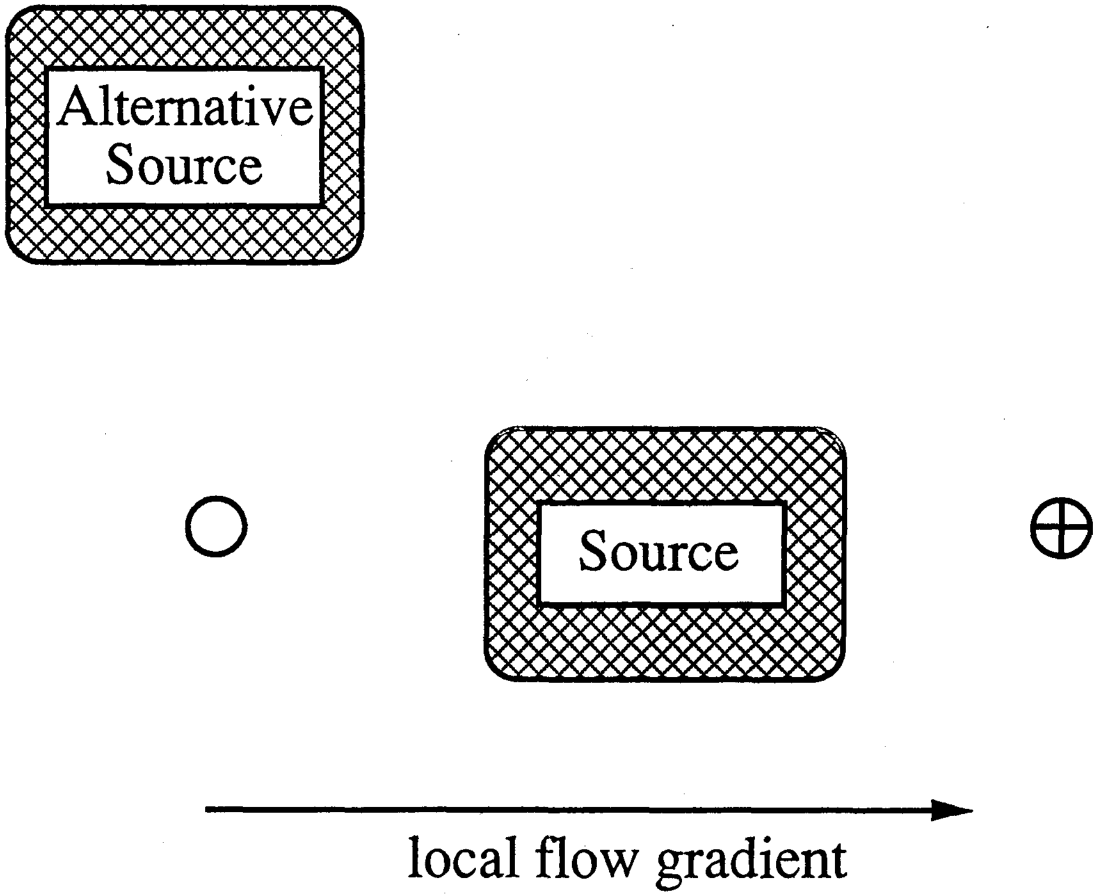
- Site documentation should give the location of potential alternative sources so that the appropriateness of the location of background samples can be assessed.

Please turn to the HRS Guidance Manual, page 59.

Attribution (Continued)



Attribution (Concluded)



Transformation Products

- Transformation products are those substances resulting from the transformation of hazardous substances in the environment by physical, chemical, and/or biological process.

- Substances found in the environment (i.e., transformation products) may be different than those found in sources at the site (i.e., parent substances).

Please turn to the HRS Guidance Manual, page 79.

Exercise 2

Please turn to the Student Exercises, Exercise 2.

Section 7

Actual Contamination

What is Actual Contamination?

- A target associated with a sampling location that meets the criteria for an observed release is subject to actual contamination.

- Actual contamination is used for assigning values to targets.

Evaluating Actual Contamination

LR x WC x T

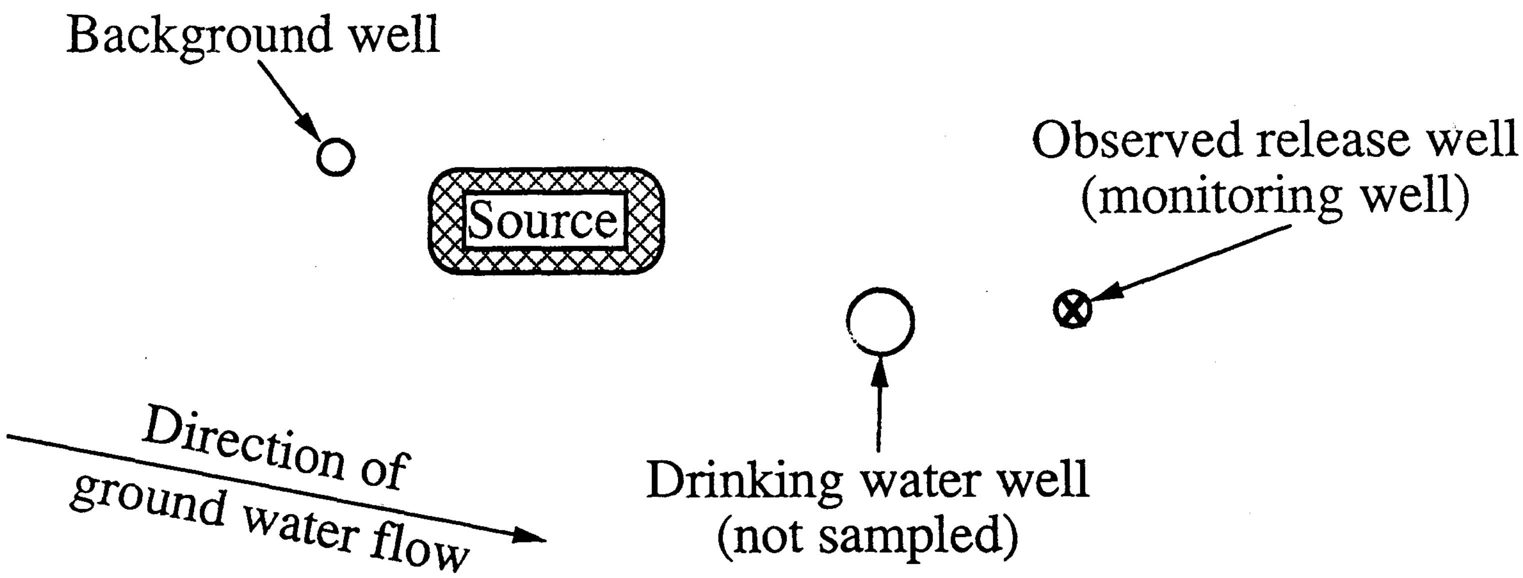
Actual Contamination

Potential Contamination

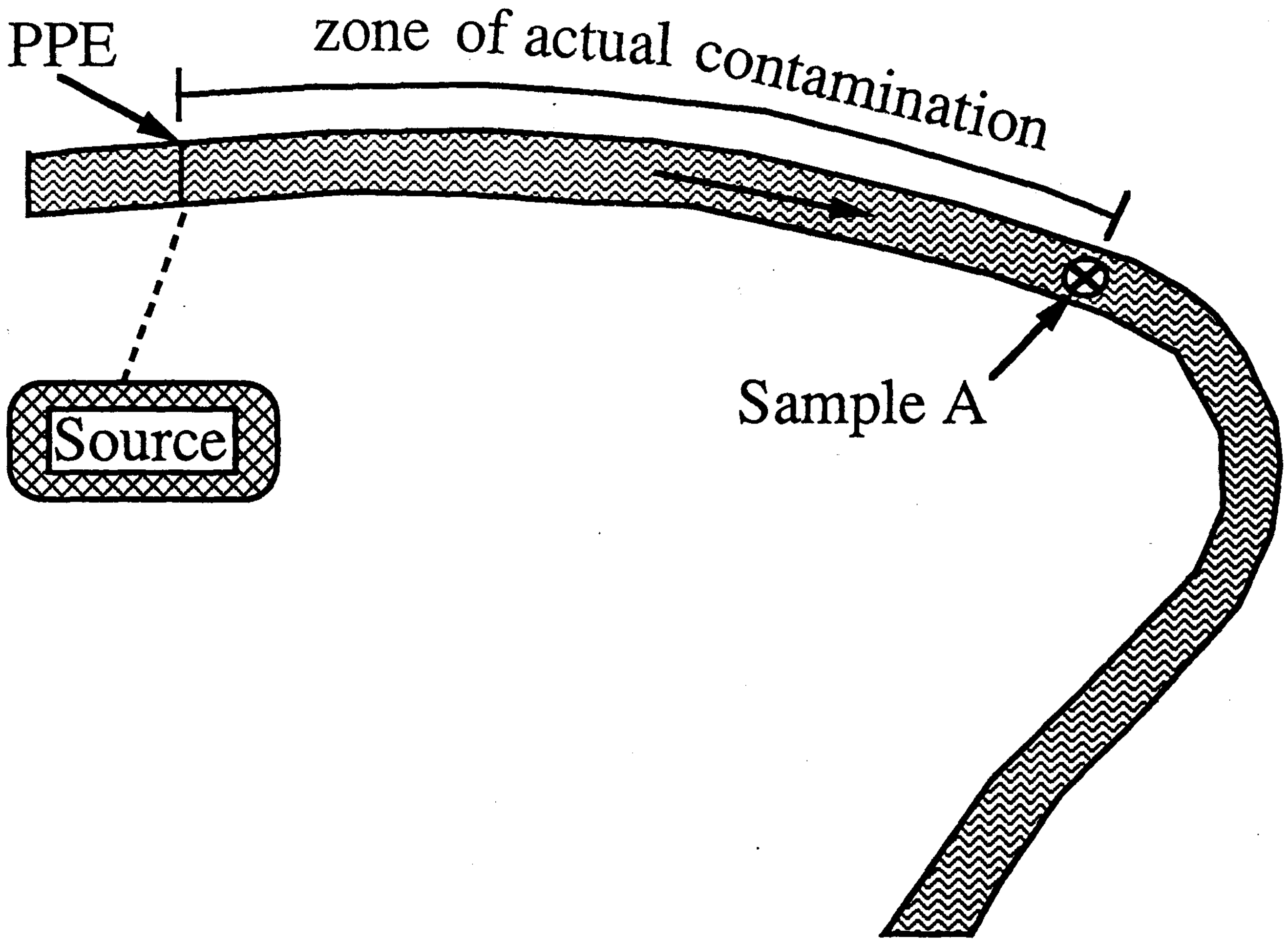
Level I

Level II

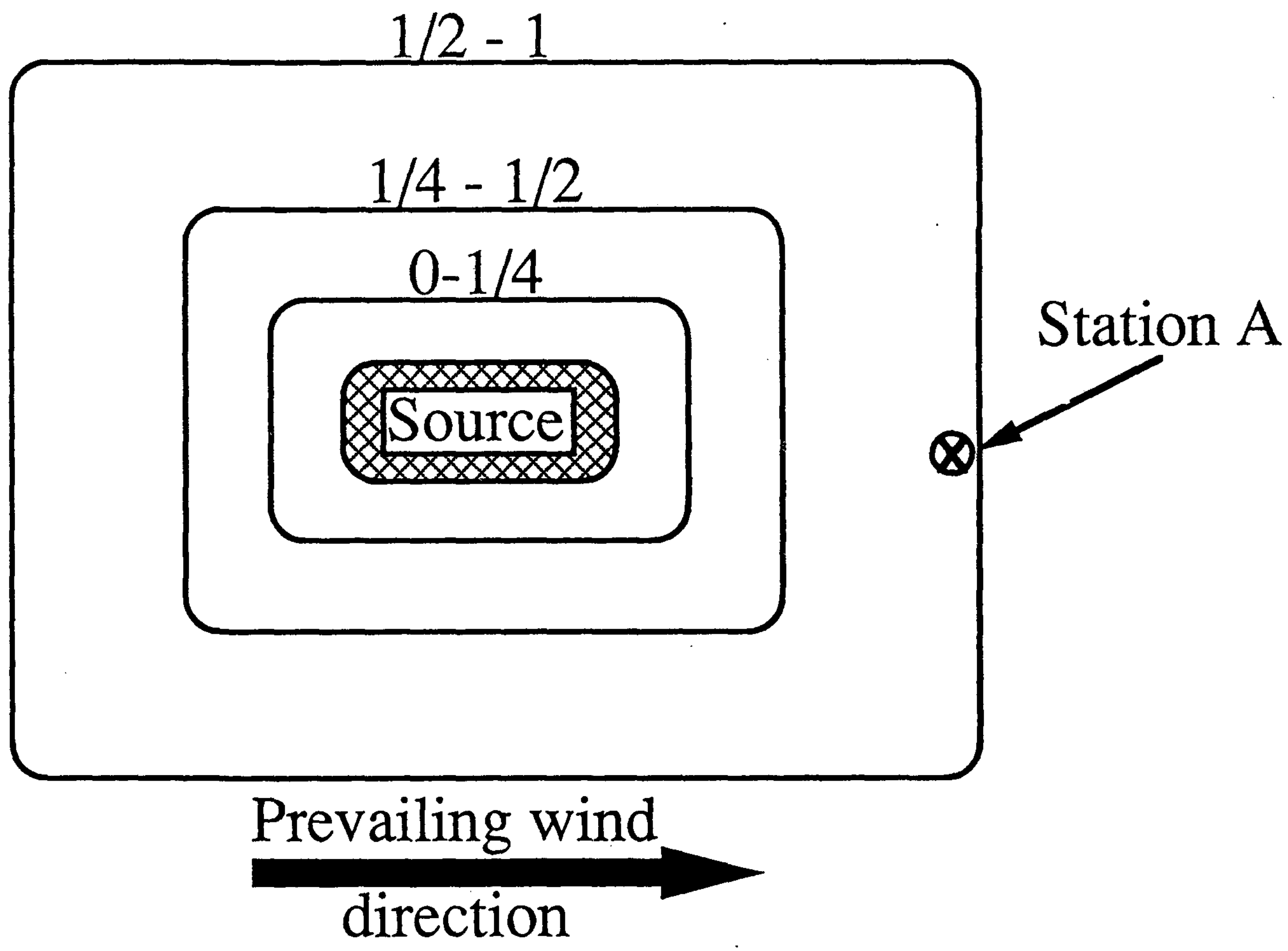
Actual Contamination - Ground Water Pathway



Actual Contamination - Surface Water Pathway



Actual Contamination - Air Pathway



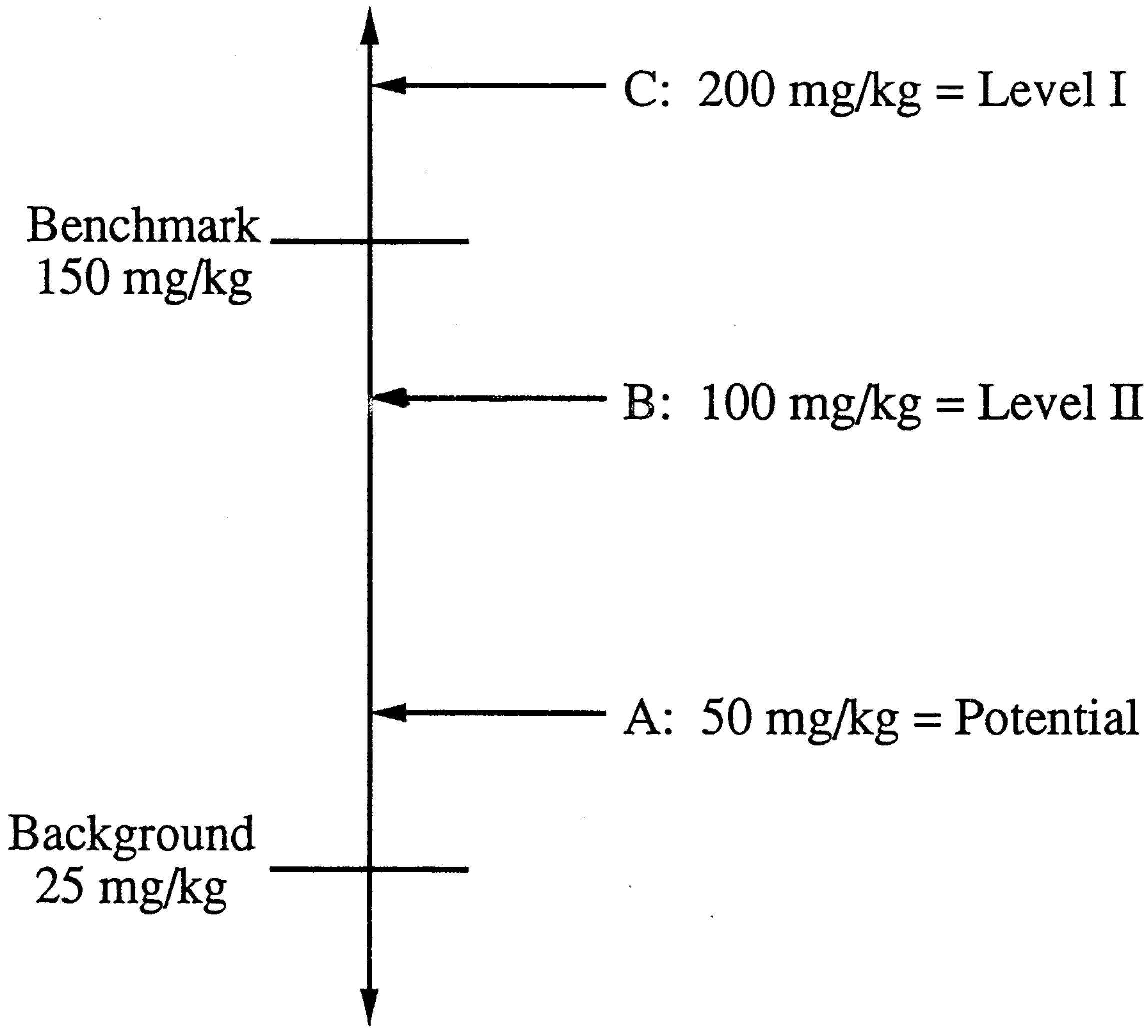
Determining Level of Contamination

- Actually-contaminated targets are further described as subject to either level I or level II concentrations.

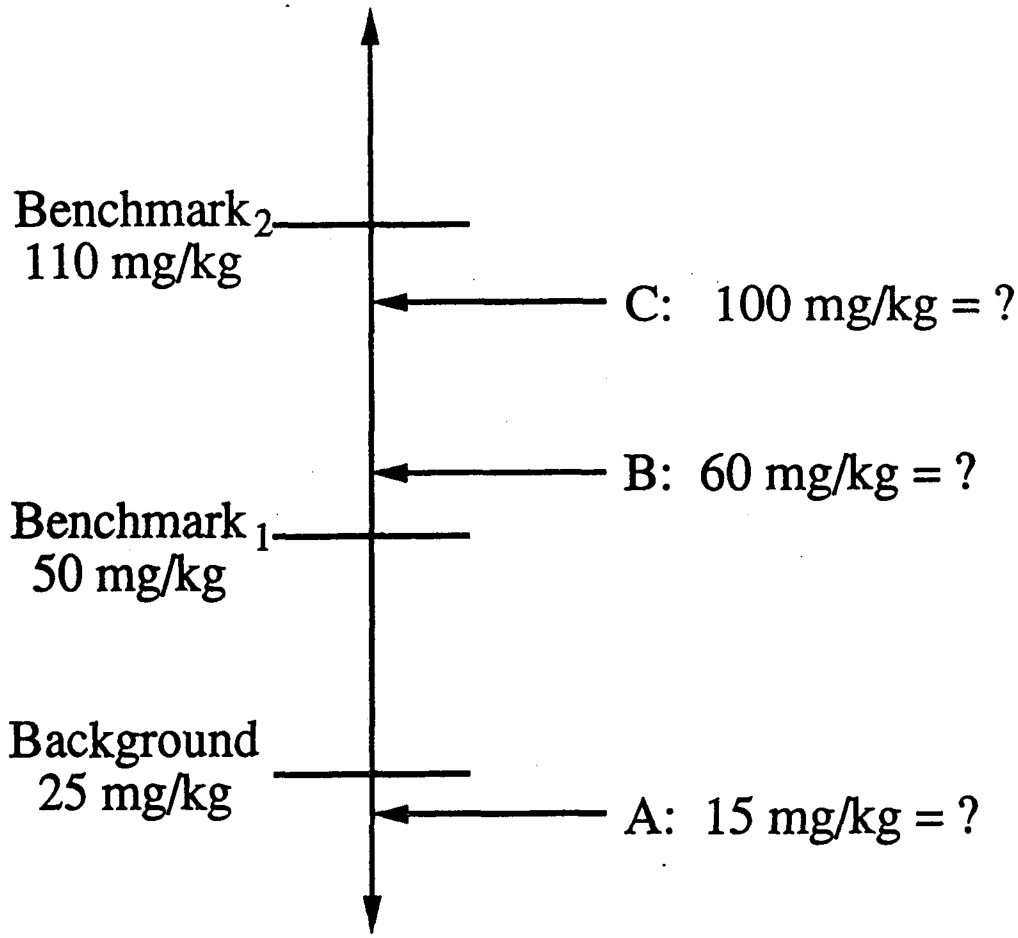
Please turn to the HRS rule,
section 2.5.2, page 51593.

Please turn to the LPQ SI report,
reference 2, page 36.

Determining Level of Contamination (Continued)



Determining Level of Contamination (Concluded)



I and J Indices

- The I and J indices calculate the additive effects of multiple contaminants.
  - The I index reflects the additive threat of cancer posed by a hazardous substance (cancer risk screening concentrations).
  - The J index reflects the additive threat of non-cancer related health effects (reference dose screening concentrations).
- Level I contamination is established if either the I or the J index is greater than or equal to 1.

Please turn to the HRS Guidance Manual, page 158.

Actual Contamination

- A target associated with a sampling location that meets the criteria for an observed release is subject to actual contamination.

- That target is subject to Level I contamination if the concentration of a hazardous substance at that sampling location meets or exceeds a media-specific benchmark.

  - Level I contamination is also established if no benchmark for a single substance is met or exceeded, but either the I or the J index is greater than or equal to 1.

- Level II contamination is established when the concentration of a hazardous substance at the sampling location satisfies the criteria for an observed release but does not meet or exceed a media-specific benchmark.

- All targets within the target distance limit that are not subject to actual contamination are subject to potential contamination.

Exercise 3

Please turn to the Student Exercises, Exercise 3.

Section 8

Sampling and Data Quality

Overview of Sampling and Data Quality

- Problems with data quality.
- SQLs, CRQLs, CRDLs, MDLs.
- Uncertainty in data.
- CLP data.
- Use of data use categories (DUCs).

Problems with Sampling Quality

- Data problems are more likely to originate in the field than in the laboratory.

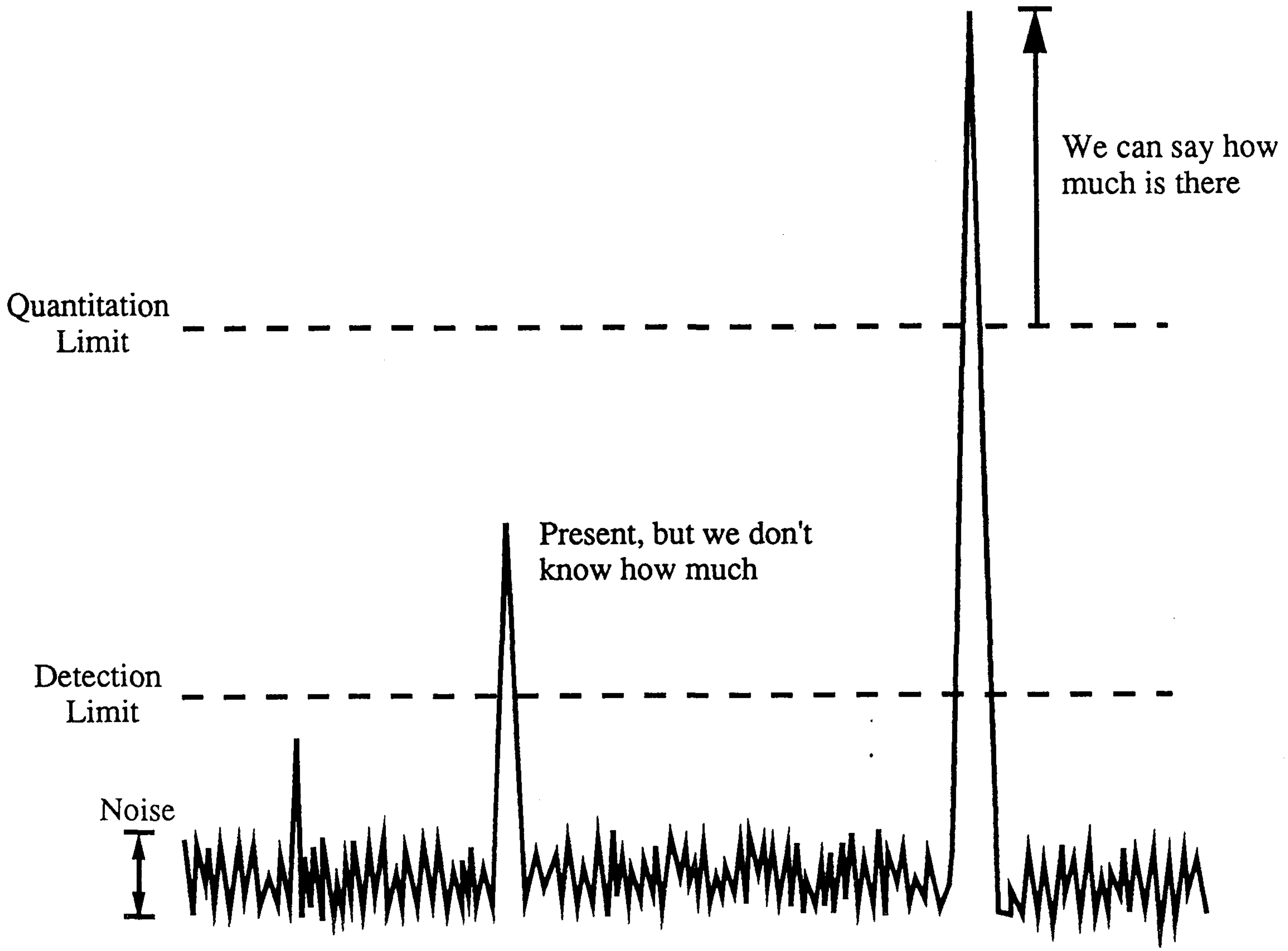
- Field activities cause orders of magnitude larger variation than lab activities.

    - How and where were the samples obtained?
    - What was the intended purpose of the sample?
    - How well is the sample collection and handling documented?

- If the quality of field sampling cannot be documented, be skeptical of the results.

> For additional information regarding sampling quality, please refer to the *Guidance for Performing Site Inspections Under CERCLA.*

Detection Limits and Quantitation Limits



Detection Limits and Quantitation Limits (Continued)

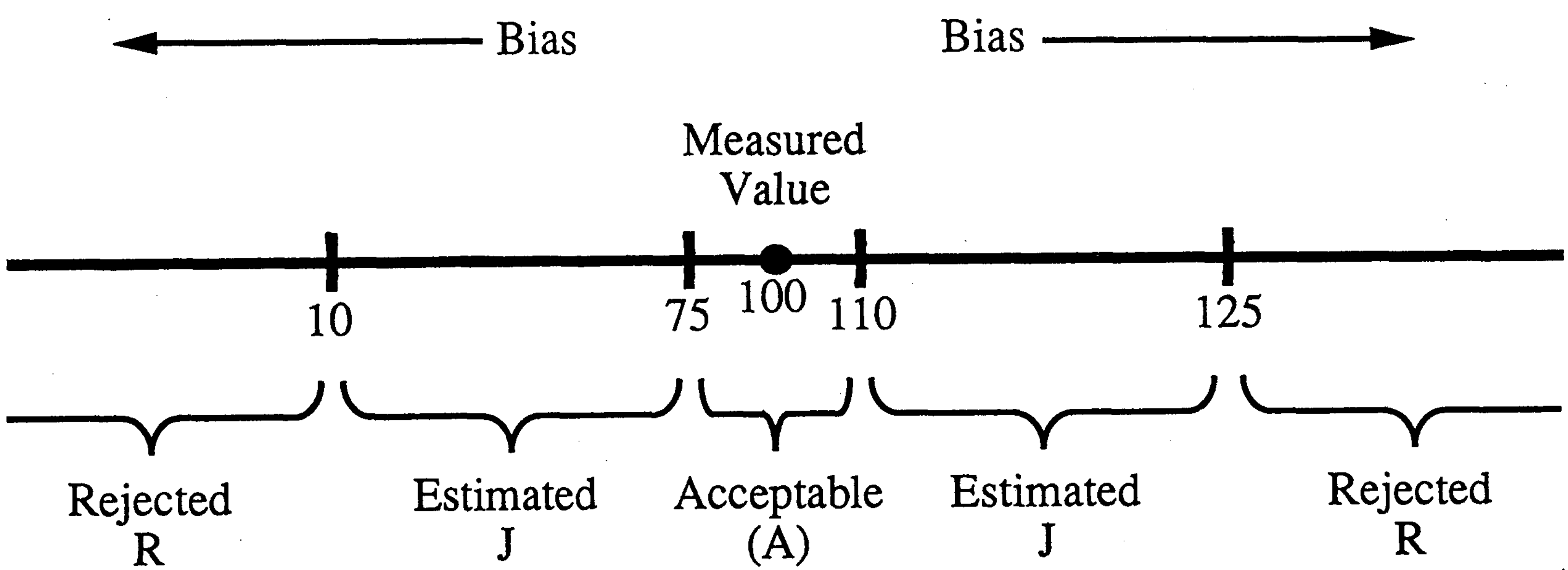
Please turn to the HRS Guidance Manual, page 57.

- If the SQL is not available, use the CRDL or CRQL for samples analyzed under the CLP; otherwise, use the method detection limit (MDL).

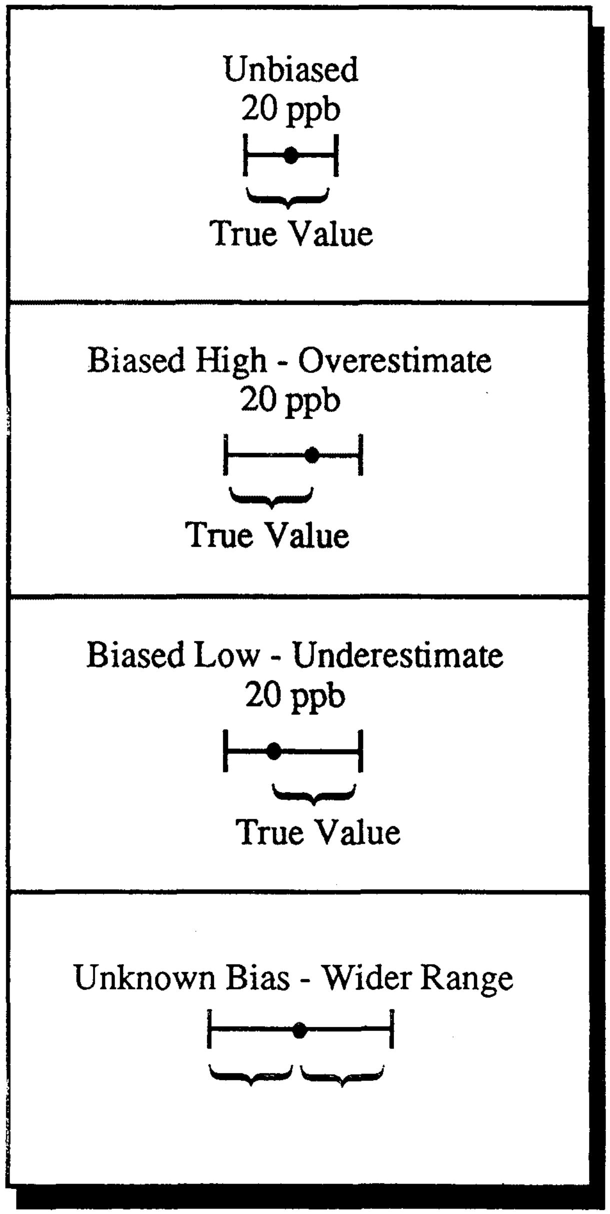
Analytical Data Requirements

- Analytical data used to establish an observed release should be of known and documented quality.
- Without quality control data and quality assurance review to support the analytical results, the results are uncertain.

Uncertainty in Analytical Data



Bias in Analytical Data



Using Qualified Data

Using "J"- qualified data for observed release		Background data			
		No bias	Bias high	Bias low	Bias unknown
Release sample data	No bias	3	3	5	5
	Bias high	30	30	40	40
	Bias low	3	3	5	5
	Bias unknown	30	30	40	40

Field Data

- Data may be obtained during the SI using accepted field techniques including:

  - Soil gas samplers
  - Air samples
  - Field gas chromatography
  - X-ray fluorescence

- Use field data to establish source boundaries and to identify locations where samples should be taken for laboratory analysis.

- Consider sending 5 to 10% of the field samples to a laboratory for confirmation.

For additional information regarding field data, please refer to the *Guidance for Performing Site Inspections Under CERCLA.*

Non-CLP Data

- Data users should request QA/QC results from anyone submitting non-CLP data for HRS evaluation, including:

  - blank samples
  - spiked samples
  - audit samples
  - replicate samples
  - other QC samples

- Data should pass an independent data validation, using criteria similar to those found in the CLP statements of work.

Data Use Categories (DUCs)

Data Quality Requirements for Data Use Categories

Data Use Category	Application
DUC-I	• To support decisions that require both substance identification and concentration. • To identify site-specific indicator chemicals.
DUC-II	• To determine extent of contamination boundaries. • To make other decisions that require quantitative data at relatively well-known levels.
DUC-III	• To determine gross contamination areas. • To make site characterization decisions that do not require numerical data.

Section 9

Ground Water Pathway -

Likelihood of Release

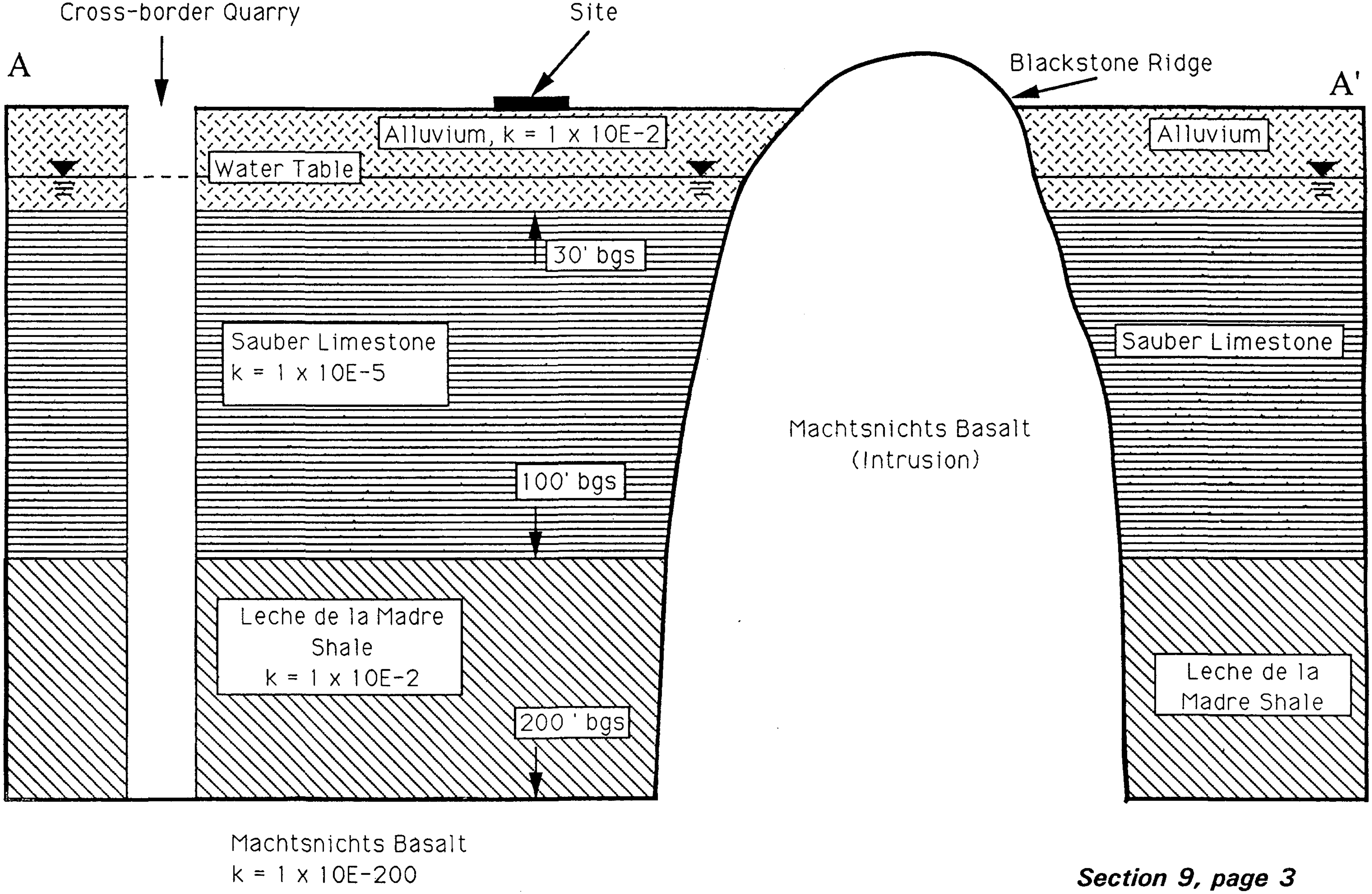
The Ground Water Pathway

LIKELIHOOD OF RELEASE		WASTE CHARACTERISTICS		TARGETS
Observed Release or Potential to Release Containment Net Precipitation Depth to Aquifer Travel Time	x	Toxicity/Mobility Hazardous Waste Quantity	x	Nearest Well Population Resources Wellhead Protection Area

Definition of Aquifer

Please turn to the HRS Guidance Manual,
page 116.

Identify and Evaluate Aquifers



Identify and Evaluate Aquifers (Concluded)

- If aquifers are in contact with one another within the TDL, and have hydraulic conductivities that differ by less than two orders of magnitude, then combine the materials into a single aquifer for HRS purposes.

Please turn to the HRS Guidance Manual, page 121, highlight 7-4.

Identify Aquifer Discontinuities

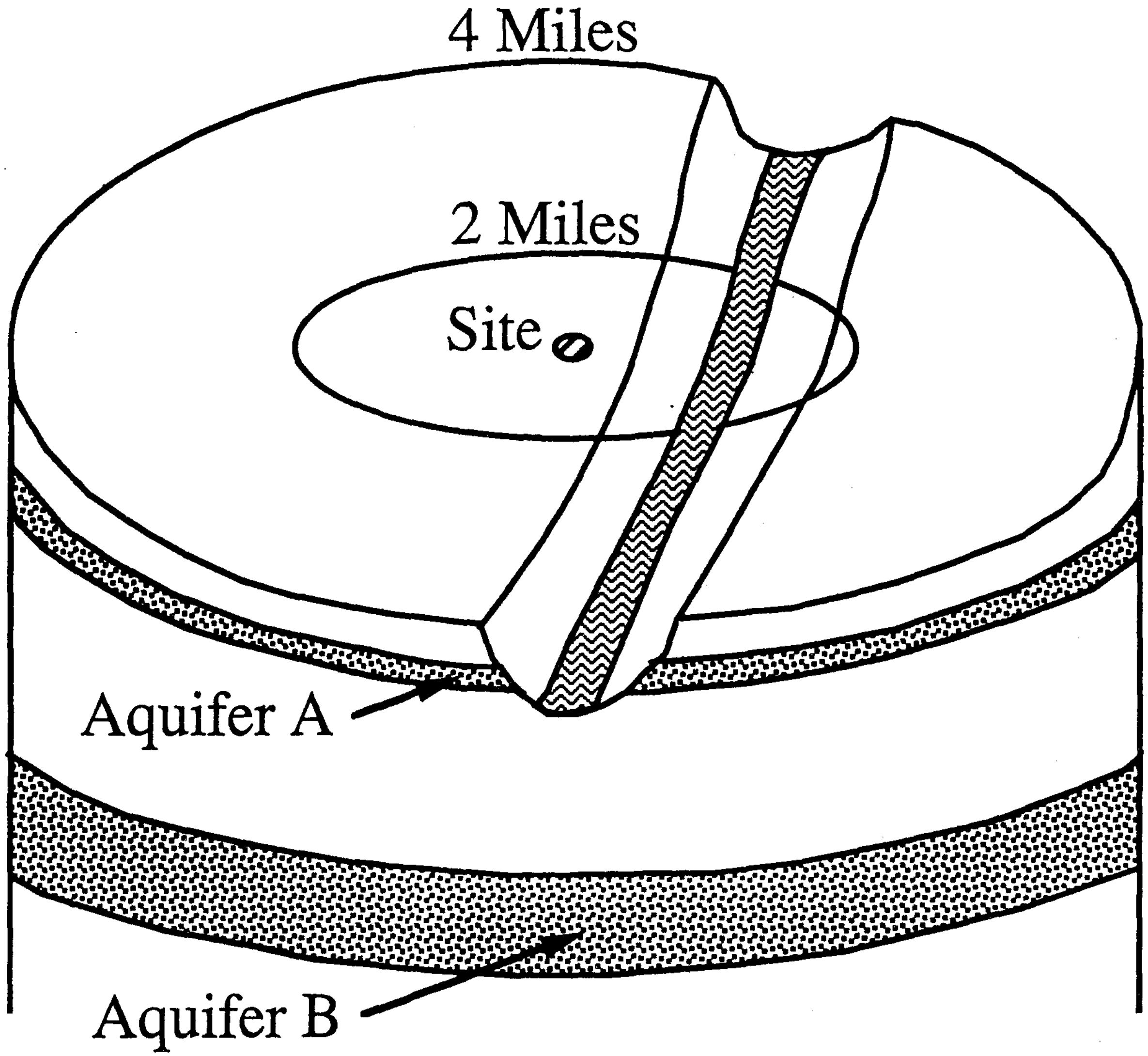
- A discontinuity is a feature that entirely transects an aquifer across the 4-mile radius.

- Examples of discontinuities:

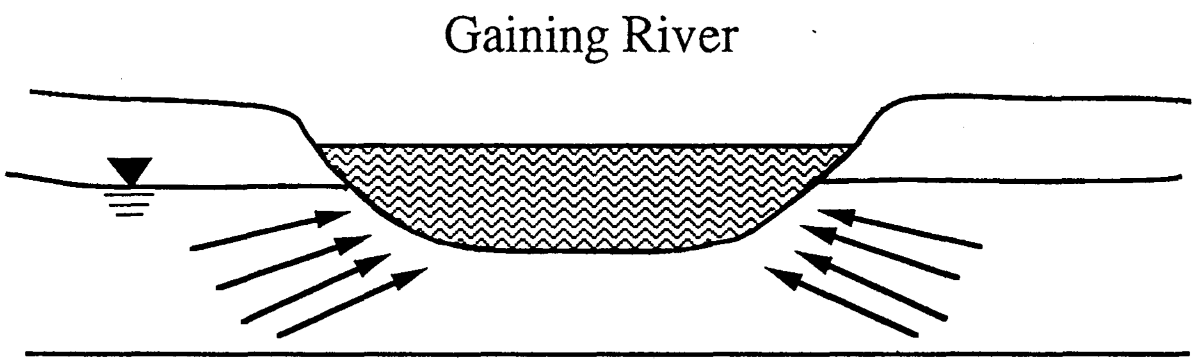
  - Major offset faults.
  - Intrusive formations (dikes and sills).
  - Erosional channels (e.g., rivers, streams).
  - Salt water interfaces.

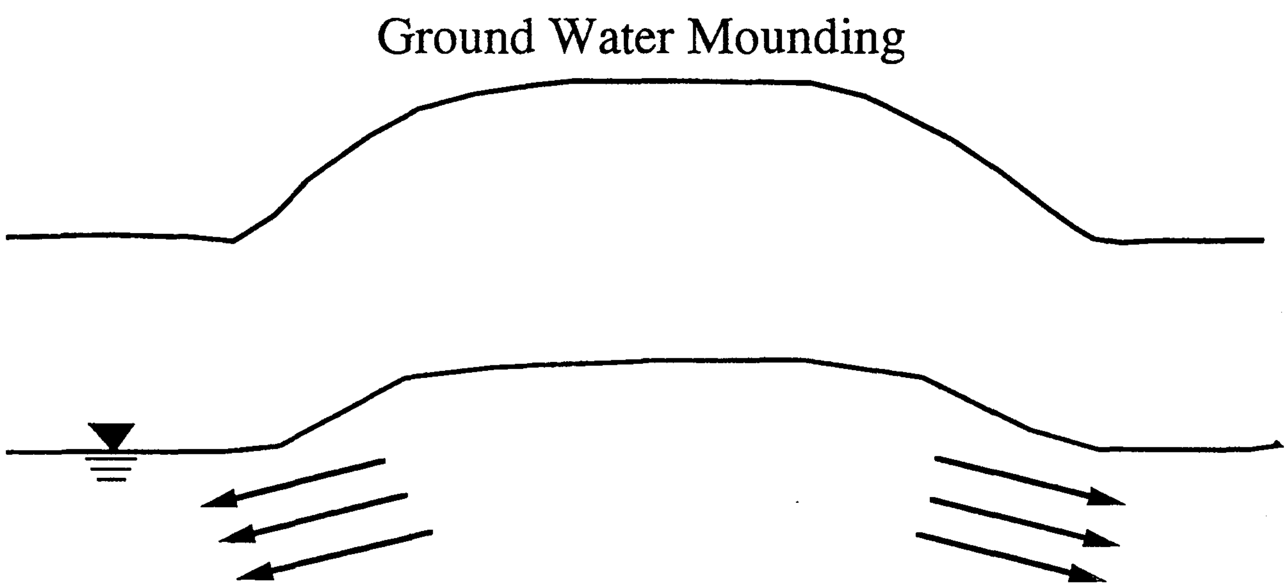
Please turn to the HRS Guidance Manual, page 136, highlight 7-14.

Identify Aquifer Discontinuities (Continued)



Identify Aquifer Discontinuities (Concluded)





Identify Aquifer Interconnections

- Interconnections must be within two miles of the sources, or within areas of observed ground water contamination that extend beyond two miles from the sources.

- If data are not adequate to establish aquifer interconnections, evaluate each aquifer separately.

Please turn to the HRS Guidance Manual, page 127.

Karst

Please turn to the HRS rule,
page 51586.

- Karst can transmit ground water rapidly and in unpredictable directions.

- The HRS rule provides special scoring provisions for when a karst aquifer underlies at least a portion of a source at the site.

Please turn to the HRS Guidance Manual,
page 137.

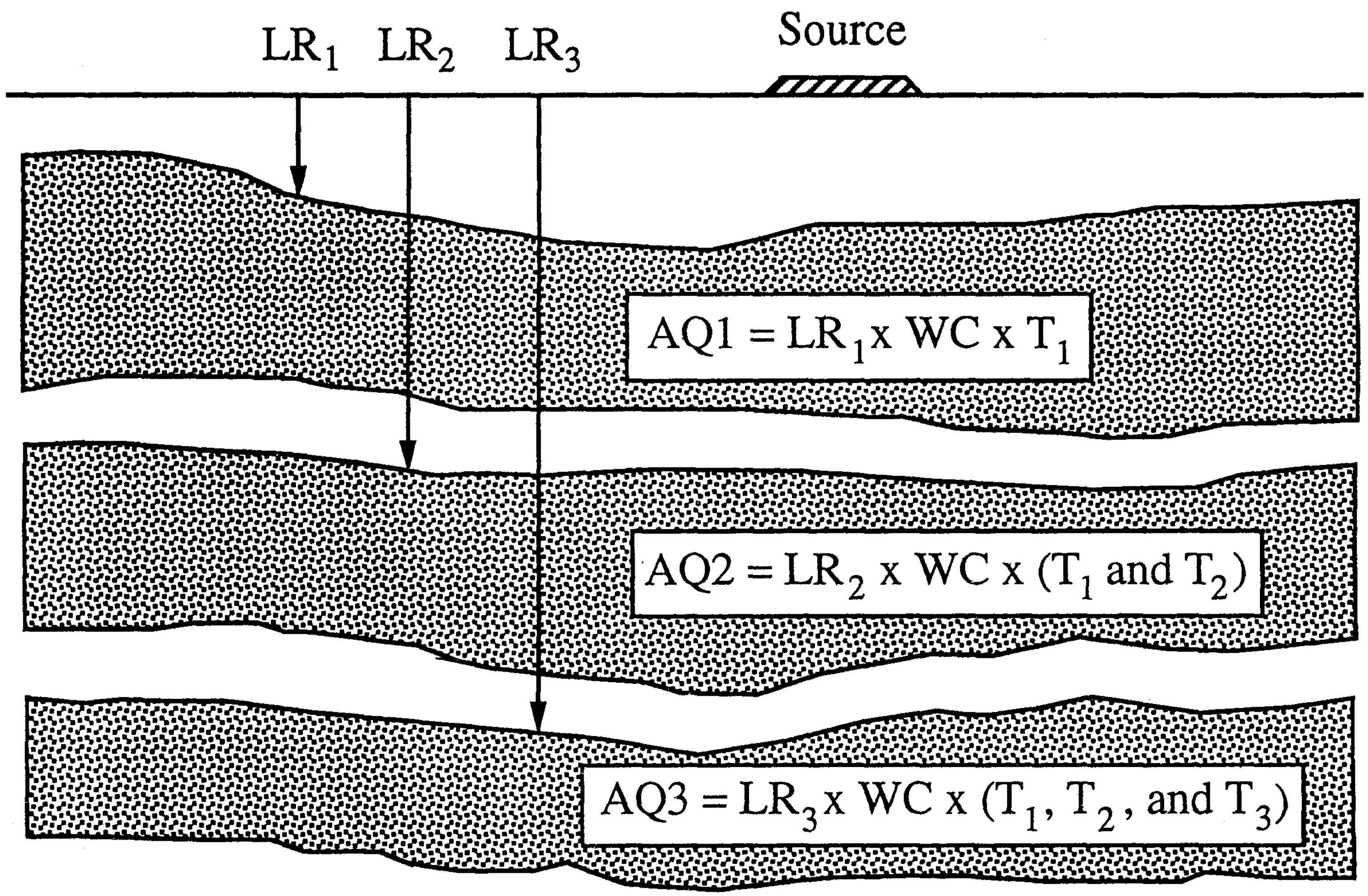
Likelihood of Release

LIKELIHOOD OF RELEASE		WASTE CHARACTERISTICS		TARGETS
Observed Release or Potential to Release Containment Net Precipitation Depth to Aquifer Travel Time	x	Toxicity/Mobility Hazardous Waste Quantity	x	Nearest Well Population Resources Wellhead Protection Area

Likelihood of Release (Continued)

Please turn to the HRS rule,
table 3-1, page 51595.

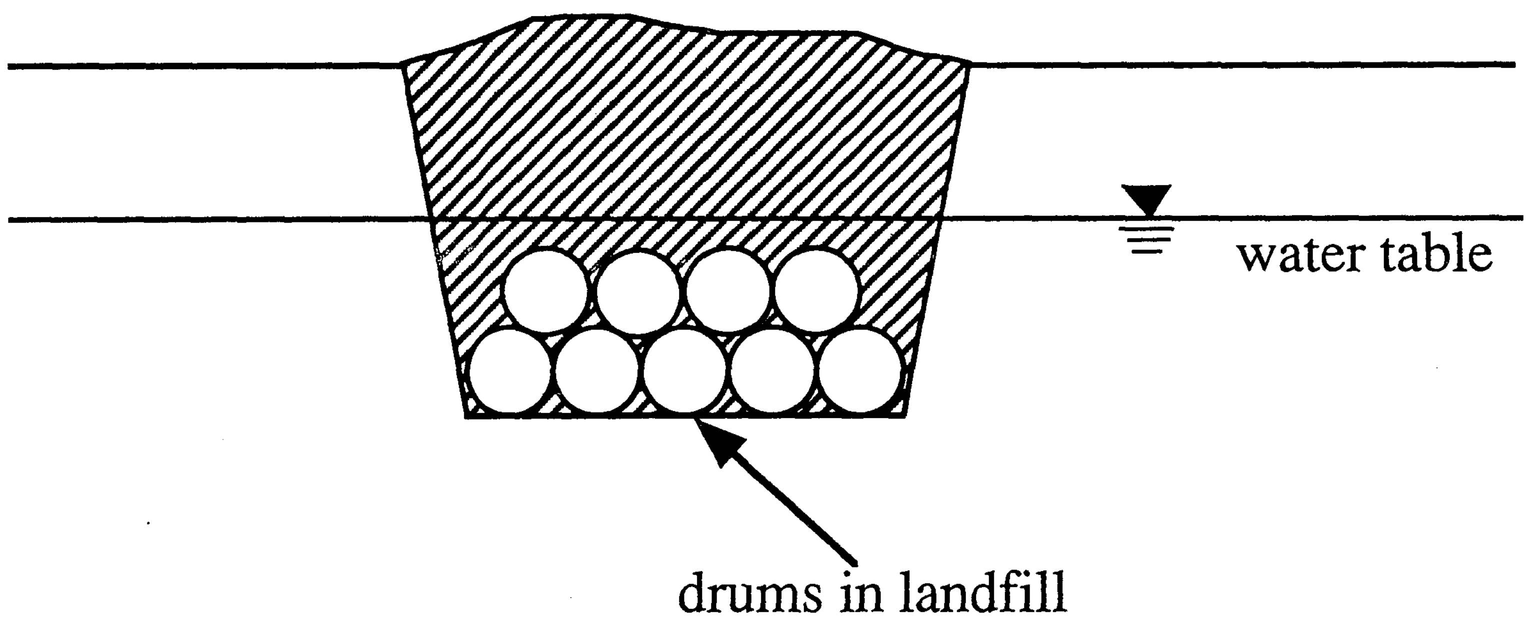
Likelihood of Release (Concluded)



Observed Release

- An observed release to ground water is based on either;
  - direct observation of the deposition of hazardous substances into an aquifer, or
  - chemical analysis of ground water samples from an aquifer.
- What is distinctive about ground water sampling?
  - The cost of monitoring wells.
  - The uncertainty about flow direction and, hence, uncertainty in both background and attribution.

Observed Release by Direct Observation



Observed Release by Chemical Analysis

- An observed release by chemical analysis is documented when analysis of ground water samples from the aquifer indicates that the concentration of hazardous substance(s) has increased significantly above the background concentration.

  - Some portion of the significant increase must be attributable to the site.

- Be sure that the background and release wells are in similar locations within the same aquifer.

Please turn to the HRS Guidance Manual, page 71, highlight 5-5.

Potential to Release

Please turn to the HRS rule,
table 3-1, page 51595.

Containment

Please turn to the HRS rule,
table 3-2, page 51596.

- Do not evaluate sources that fail to meet the minimum size requirement of a hazardous waste quantity value greater than or equal to 0.5.

- If no sources at the site meet the minimum size requirement, then evaluate all of the sources at the site.

Please turn to the HRS Guidance Manual
page 150, highlight 7-23.

Net Precipitation

- Net precipitation is the driving force, once containment is lost, for migration to the aquifer.

Please turn to the HRS rule,
figure 3-2, page 51598-9.

- For sites that cannot be assigned a value from figure 3-2, a method for calculating net precipitation is provided in the HRS.

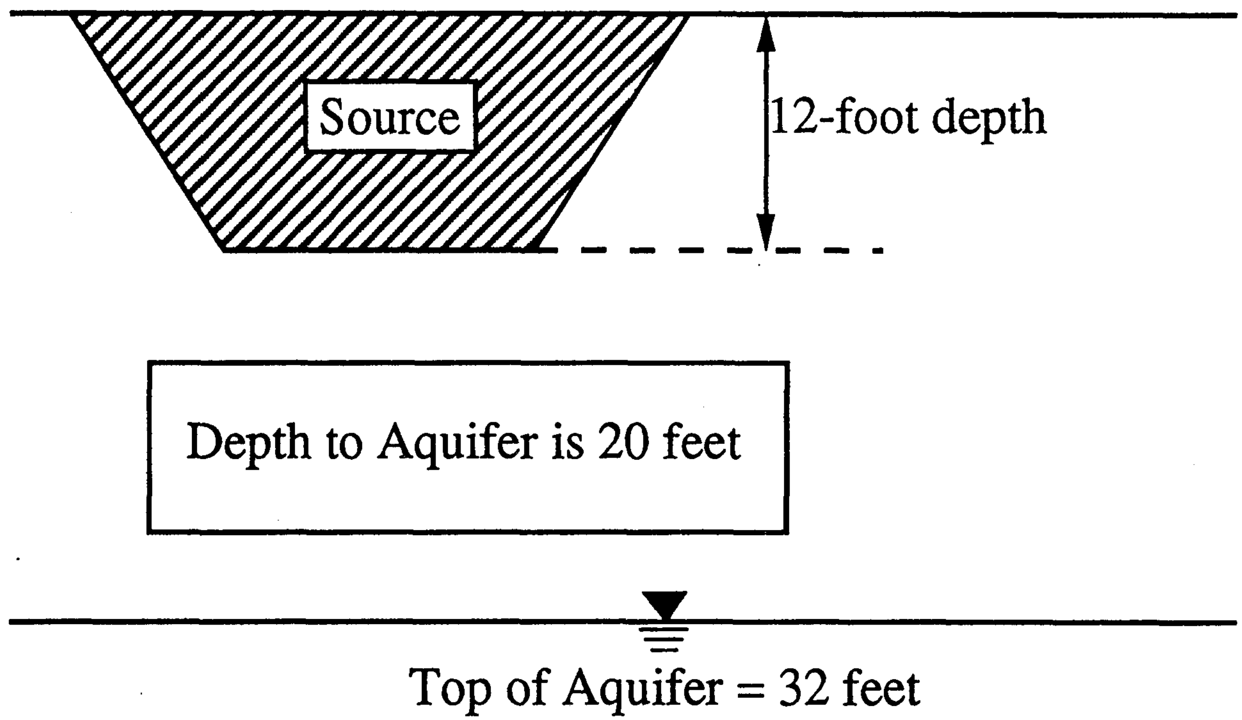
Please turn to the HRS rule,
page 51600.

Depth to Aquifer

- Depth to aquifer is the net of two measurements:
  - The depth from the surface to the lowest known point of hazardous substances at the site.
  - The depth from the surface to the top of the aquifer being evaluated.
- These measurements must be made within 2 miles of the sources on site (unless an observed release extends beyond the 2- miles radius).
- Intervening karst aquifers are assigned a thickness of 0.

Please turn to the HRS rule,
table 3-5, page 51600.

Depth to Aquifer (Concluded)



Travel Time

- Travel time is based on the thickness and the hydraulic conductivity of the least permeable layer between the lowest known location of hazardous substances and the top of the aquifer.
- Travel time values are reduced by layers that are either thick or have relatively low hydraulic conductivities.
- Measurements must be made within two miles of sources, but not necessarily at same location as depth to aquifer.

Travel Time (Continued)

- Assign the maximum value of 35:
  - if the depth to aquifer is 10 feet or less, or
  - if all intervening layers under a source are karst.
- Do not consider layers in the first 10 feet of the depth to aquifer.
- Do not consider any layer or portion of a layer which is less than 3 feet thick.
  - Such a layer is considered not likely to be continuous over the two mile radius.

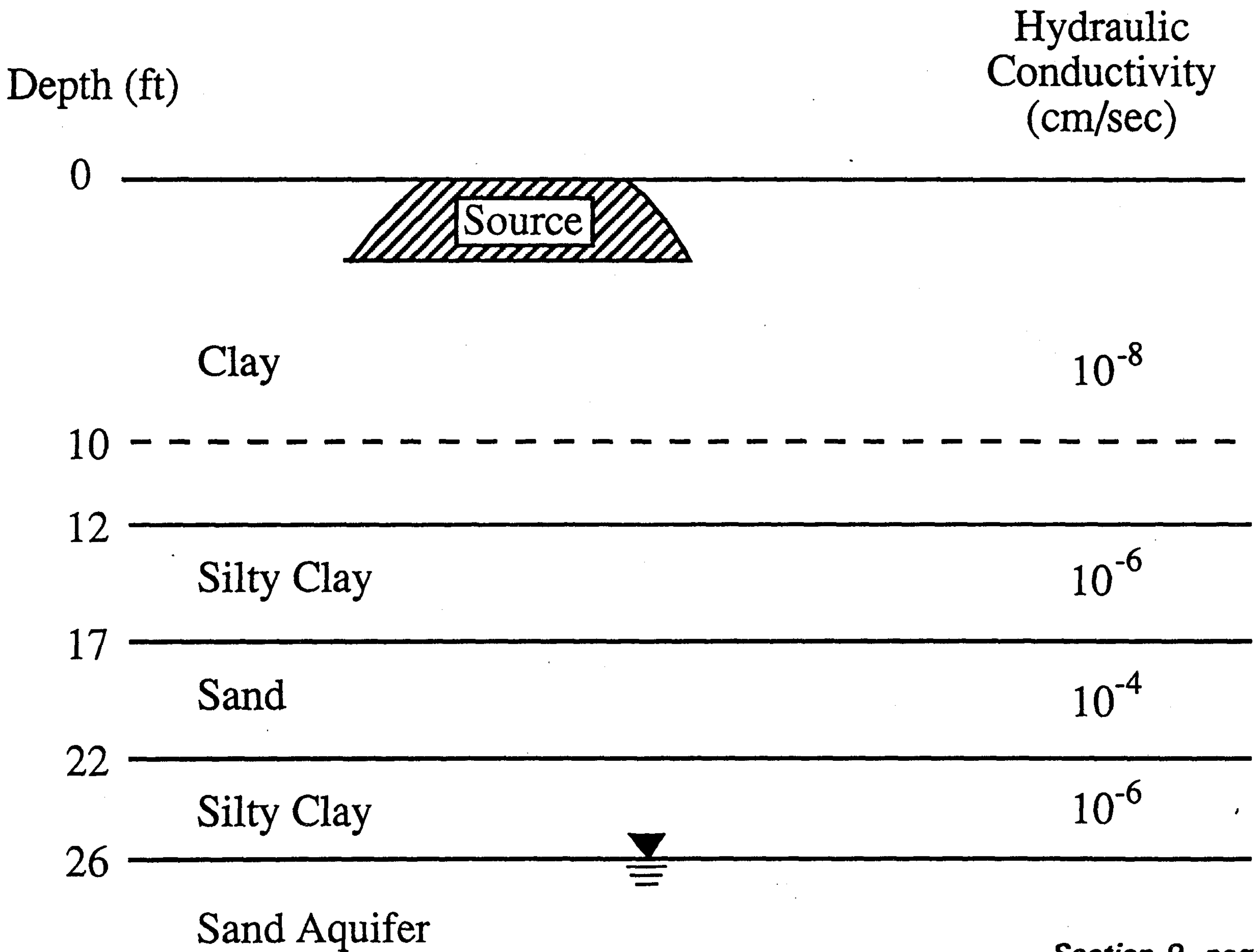
Travel Time (Continued)

- Determine the hydraulic conductivities for the remaining layers.
  - Actual, measured hydraulic conductivity values are preferred.
  - The HRS rule provides default values.

Please turn to the HRS rule,
table 3-6, page 51601.

- Select the least permeable layer and determine its thickness (in feet).
  - If two or more layers have the same lowest hydraulic conductiviey, combine their thicknesses.

Travel Time (Concluded)



Likelihood of Release

Please turn to the HRS rule,
table 3-1, page 51595.

Exercise 4

Please turn to the Student Exercises,
Exercise 4.

Section 10

Ground Water Pathway -

Waste Characteristics and Targets

Waste Characteristics

Please turn to the HRS rule,
figure 3-1, page 51594.

- Toxicity, mobility, and hazardous waste quantity are multiplied by each other to obtain a waste characteristics value.
- Evaluate only those quantities and substances that are found in sources with a non-zero value for containment.
- In addition, evaluate those substances that are found in an observed release to ground water.

Please turn to the HRS rule,
table 3-1, page 51595.

Toxicity

- The toxicity values are based on:
  - Cancer risk.
  - Non-cancer effects of chronic exposure.
  - Non-cancer effects of acute exposure.
- Assign a toxicity factor value to each eligible substance using SCDM.

Mobility

- The mobility factor value for a substance is based on:
  - the solubility of the substance in water, and
  - the distribution coefficient for that substance (the tendency of the substance to be sorbed).

Please turn to the HRS rule,
table 3-8, page 51601.

- Assign a value to each eligible substance using SCDM.

Please turn to the LPQ SI report,
reference 2, page 38.

Mobility (Concluded)

- If a substance is found in an observed release by chemical analysis (not by direct observation) to any aquifer, its mobility value is 1.

- The documentation of an observed release for a wide range of substances increases the likelihood of assigning a high waste characteristics factor value.

  - This illustrates the importance of careful SI sample planning.

Toxicity/Mobility

- Multiply the toxicity factor value by the mobility factor value, for each substance.

- The most hazardous substance for the ground water pathway is the one with the highest toxicity/mobility product.

- Note that many substances that are highly toxic have low values for ground water mobility.

  - PCBs, which are highly toxic (toxicity value of 10,000), sorb easily and have a mobility value of 0.0001, even when in a liquid state.

Hazardous Waste Quantity

- Evaluate hazardous waste quantity based only on those sources that have a ground water containment value greater than 0.

Waste Characteristics Factor Category Value

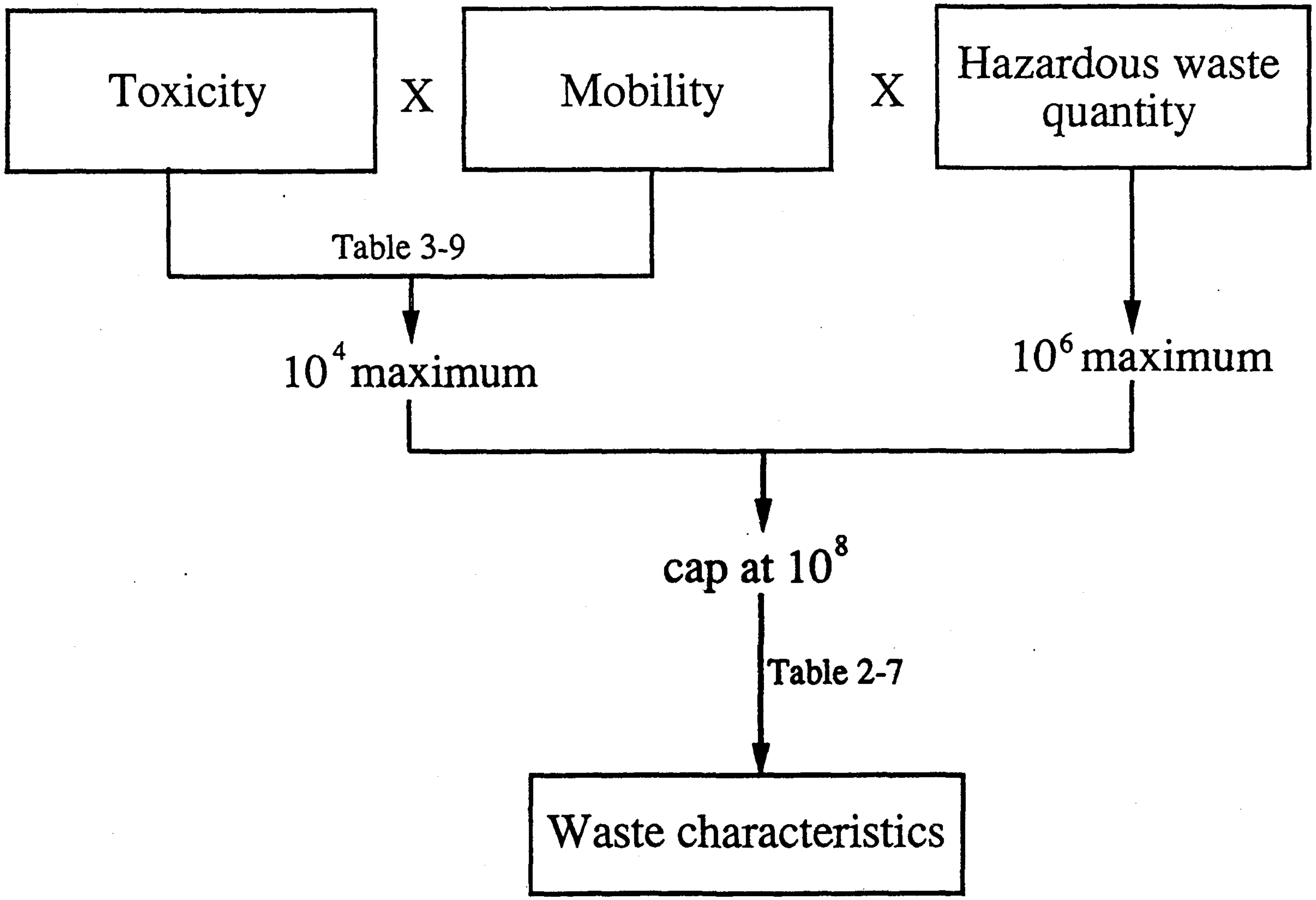
- Multiply the toxicity/mobility and hazardous waste quantity values, subject to a maximum product of 1×10^8.

- Based on this product, assign a value from HRS rule table 2-7 to the waste characteristics factor category.

Please turn to the HRS rule,
table 2-7, page 51592.

Please turn to the HRS rule,
table 3-1, page 51595.

Waste Characteristics (Concluded)



Targets Overview

LIKELIHOOD OF RELEASE		WASTE CHARACTERISTICS		TARGETS
Observed Release or Potential to Release Containment Net Precipitation Depth to Aquifer Travel Time	x	Toxicity/Mobility Hazardous Waste Quantity	x	Nearest Well Population Resources Wellhead Protection Area

Targets Overview (Concluded)

Please turn to the HRS rule,
table 3-1, page 51595.

- The relative ratings are seen in the maximum values:
  - Nearest well 50
  - Population no cap
  - Resources 5
  - Wellhead protection area 20

Actual Contamination of Targets

- **Actual contamination (level I or level II) cannot be inferred. Samples documenting actual contamination must be taken at each drinking water well.**

  - **Level I = target wells are contaminated (by observed release criteria) at concentrations at or above a benchmark.**

  - **Level II = target wells are contaminated (by observed release criteria), but not at or above any benchmark.**

  - **Potential = target wells are not known to be contaminated.**

Nearest Well

Please turn to the HRS rule, table 3-11, page 51603.

- If a drinking water well is subject to actual contamination:
  - *Assign a value of 50 for level I concentrations.*
  - Assign a value of 45 for level II concentrations.
- If no drinking water well is subject to actual contamination (potential contamination):
  - Assign a value of 20 if a karst aquifer underlies a source and also supplies a drinking water well.
  - If not, measure the distance from a source to the nearest drinking water well and assign a distance-weighted value.

Population

- Population values are based on the number of residents, students, and workers who drink water from wells within the target distance limit (although the people may be outside the target distance limit).

> **Please turn to the HRS Guidance Manual, page 164, highlight 7-31.**

- Actual contamination (level I or level II) is based on samples taken from the drinking water well that serves the target population.

    - Level I concentrations: 10 points per person
    - Level II concentrations: 1 point per person

Population (Continued)

- For potential population, sum the residents, workers, and students served by wells located within each distance ring.
  - HRS rule table 3-12 is used to distance-weight the potentially exposed population.

Please turn to the HRS rule,
table 3-12, page 51604.

  - The karst section assigns higher population values for distances over 1/2 mile from a source.
- The values taken from HRS table 3-12 are then multiplied by 1/10 to obtain a potential contamination factor value.

Population (Continued)

Please turn to the HRS Guidance Manual, page 165.

Population (Concluded)

Please turn to the HRS Guidance Manual,
page 168, highlight 7-33.

Blended Water Supply

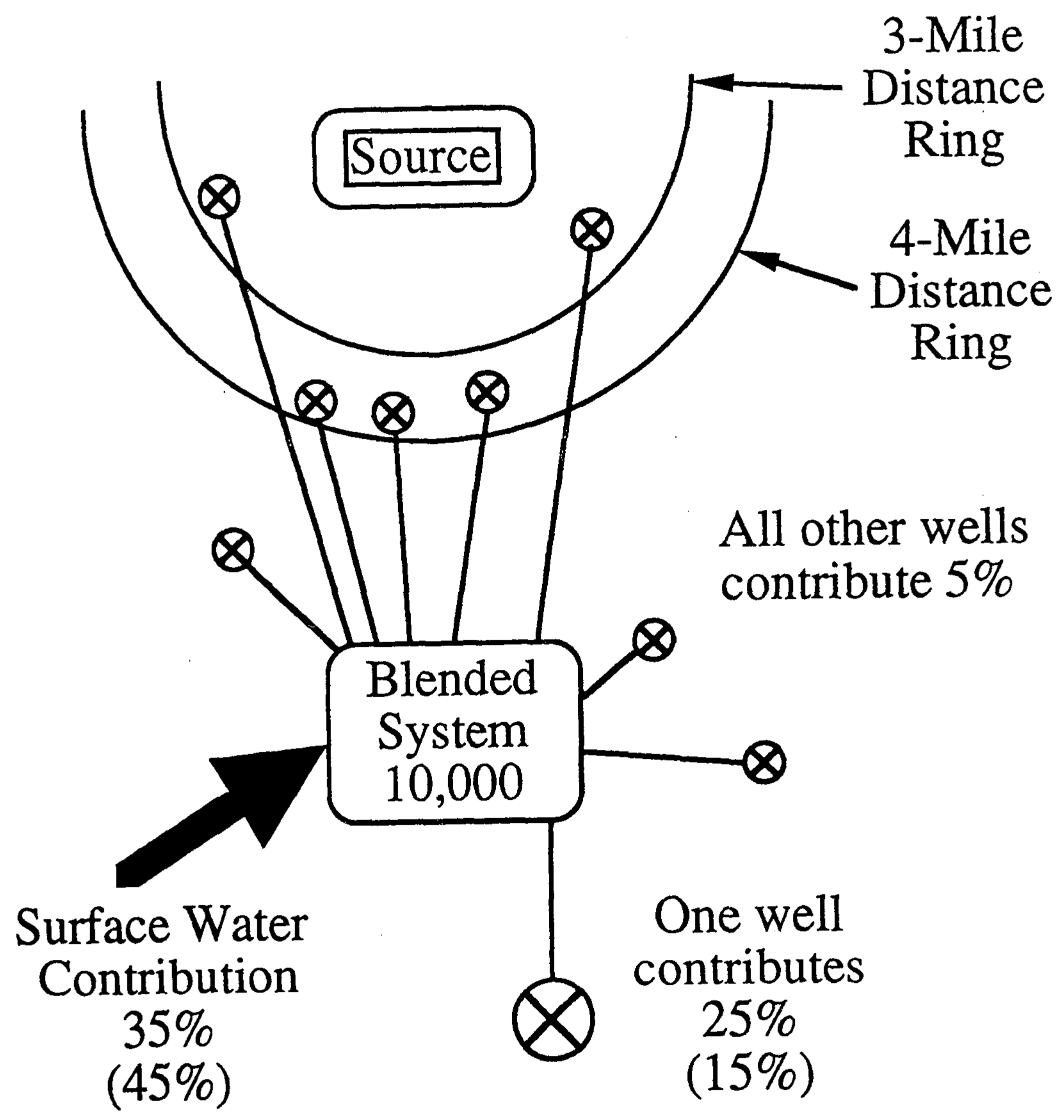
- In order to evaluate the population served by an individual well in a blended system, the total population is apportioned based on the well's relative contribution to the total blended system.

- Relative contribution is determined using data on average annual pumpage, or well capacity.

- If no source of drinking water (well or intake) exceeds 40% relative contribution, then assume each source contributes equally and apportion the population equally.

- If a source of drinking water (well or intake) exceeds 40%, then apportion the population according to percent contribution.

Blended Water Supply (Concluded)



Standby Wells

- If a standby well located within the target distance limit draws water from the aquifer being evaluated or from any overlying aquifer, the well may be used to evaluate both the nearest well and population factors.
- To designate a standby well as the nearest well it must be used for drinking water supply at least once every year.
- A standby well can be used to evaluate the population factor if it is maintained on a regular basis so that water can be withdrawn.

Please turn to the HRS Guidance Manual, page 187.

Resources

Please turn to the HRS Guidance Manual, page 195, highlight 7-46.

Wellhead Protection Area

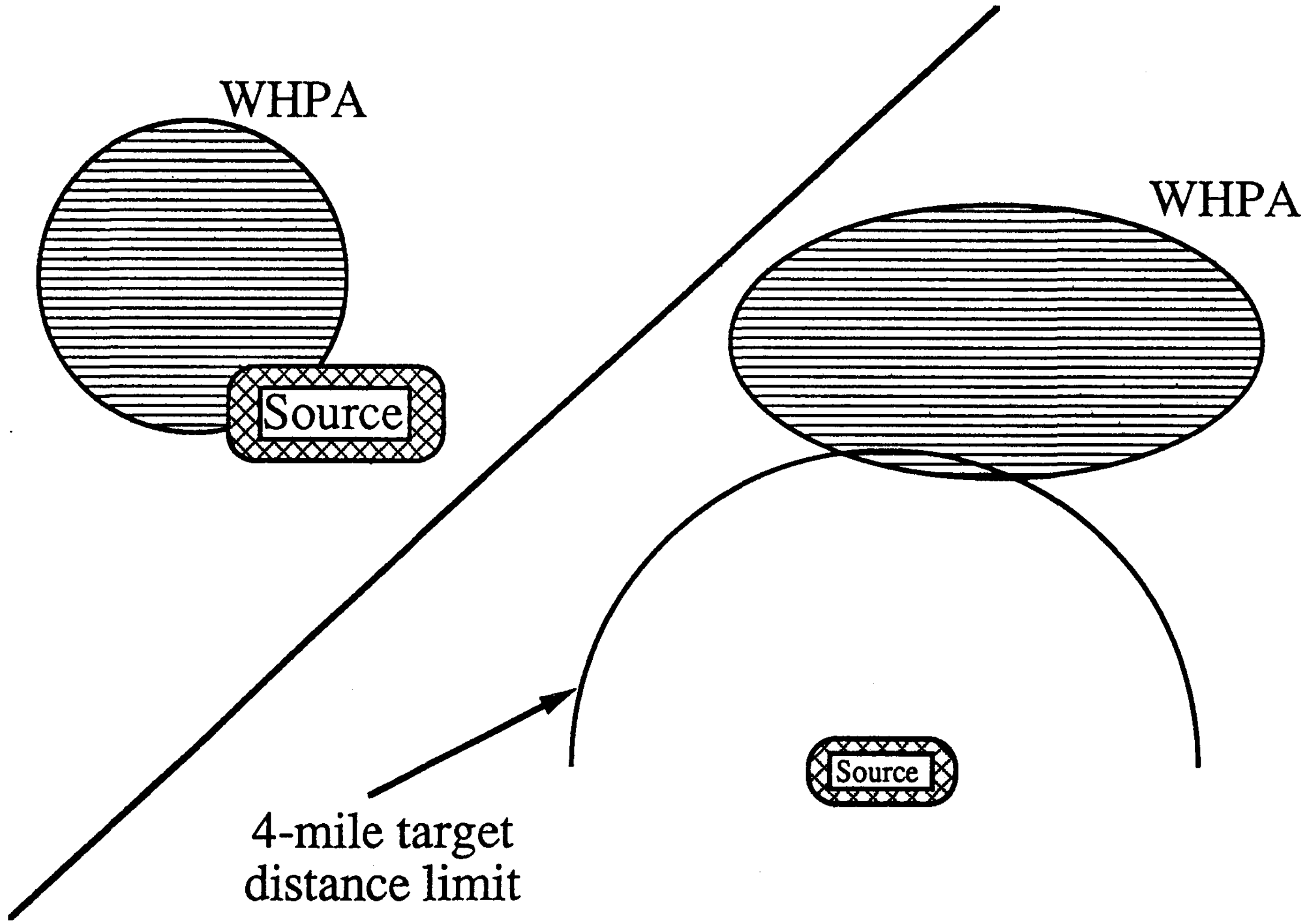
- In order to be scored under the HRS, a wellhead protection area (WPA) must have been formally established under section 1428 of the Safe Drinking Water Act.

    - Each state lists and publishes their WPAs.

- Sole source aquifers are not considered under this factor, nor are informally defined protection areas.

Please turn to the HRS Guidance Manual, page 194.

Wellhead Protection Area (Concluded)



Targets Factor Category

Please turn to the HRS rule,
table 3-1, page 51595.

Exercise 5

Please turn to Student Exercises,
Exercise 5.

Section 11

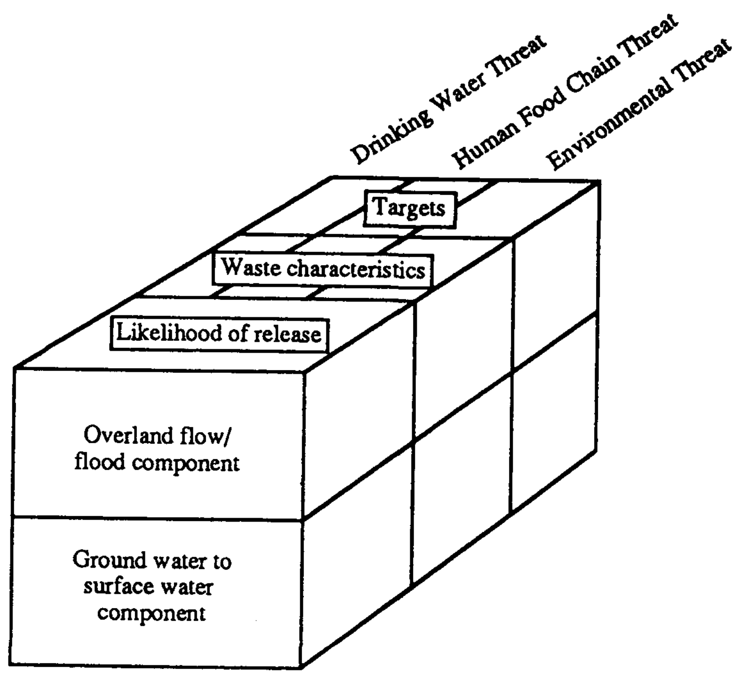
Surface Water Pathway -

Likelihood of Release

The Surface Water Pathway

- The surface water pathway consists of two migration components: the overland flow/flood component and the ground water to surface water component.

- Evaluate both components based on the same three threats: drinking water threat, human food chain threat, and environmental threat.



Eligible Surface Water Bodies

Please turn to the HRS Guidance Manual, page 207, highlight 8-4.

- Map the surface water migration pathway, giving careful consideration to boundaries between eligible surface water bodies.

Please turn to the HRS Guidance Manual, page 232, highlight 8-20.

Hazardous Substance Migration Path

- The hazardous substance migration path is the path that hazardous substances travel or would travel over land from a source to surface water and within surface water to the TDL.

  - The hazardous substance migration path includes both the overland segment and the in-water segment.

Please turn to the HRS Guidance Manual, page 205, highlight 8-1.

The Overland Segment

- The overland segment is the route that runoff would take from a source to a surface water body.
- Site observations are generally the best method of defining the overland segment and identifying the PPE.

Please turn to the HRS Guidance Manual, page 204.

Watersheds

- Define and delineate watersheds for HRS scoring purposes as those portions of watersheds downgradient of sources at the site.

- Compile maps that show the sources evaluated and all surface water bodies within the TDL.

Please turn to the HRS Guidance Manual, page 222, highlight 8-16.

Likelihood of Release

Please turn to the HRS rule, table 4-1, page 51608.

- Evaluate the likelihood of release factor for each watershed in terms of either an observed release factor or a potential to release factor.
- Evaluate potential to release based on two components: potential to release by overland flow and potential to release by flood.
- Likelihood of release is evaluated once and is the same for all three threats in the overland flow/flood component.

Containment

Please turn to the HRS rule,
table 4-2, pages 51609-10.

Please turn to the HRS Guidance Manual,
page 244.

Runoff

- The runoff factor value is evaluated using three components: drainage area, soil group, and rainfall.

- Drainage area includes both the source areas and the area up-gradient of the sources.

  - Exclude any portion of the drainage area for which runoff is diverted from entering the sources by man-made structures.

Please turn to the HRS Guidance Manual, page 225, highlight 8-18.

Please turn to the HRS Rule, table 4-3, page 51611.

Runoff (Concluded)

- Soil group designations are based on the predominant soil group within the drainage area.

  - If a predominant soil group cannot be determined, select the soil group in the drainage area that yields the highest value.

Please turn to the HRS rule, table 4-4, page 51611.

- The rainfall value is equal to the 2-year, 24-hour rainfall for the site.

- Derive the rainfall/runoff value and runoff factor value using HRS tables 4-5 and 4-6.

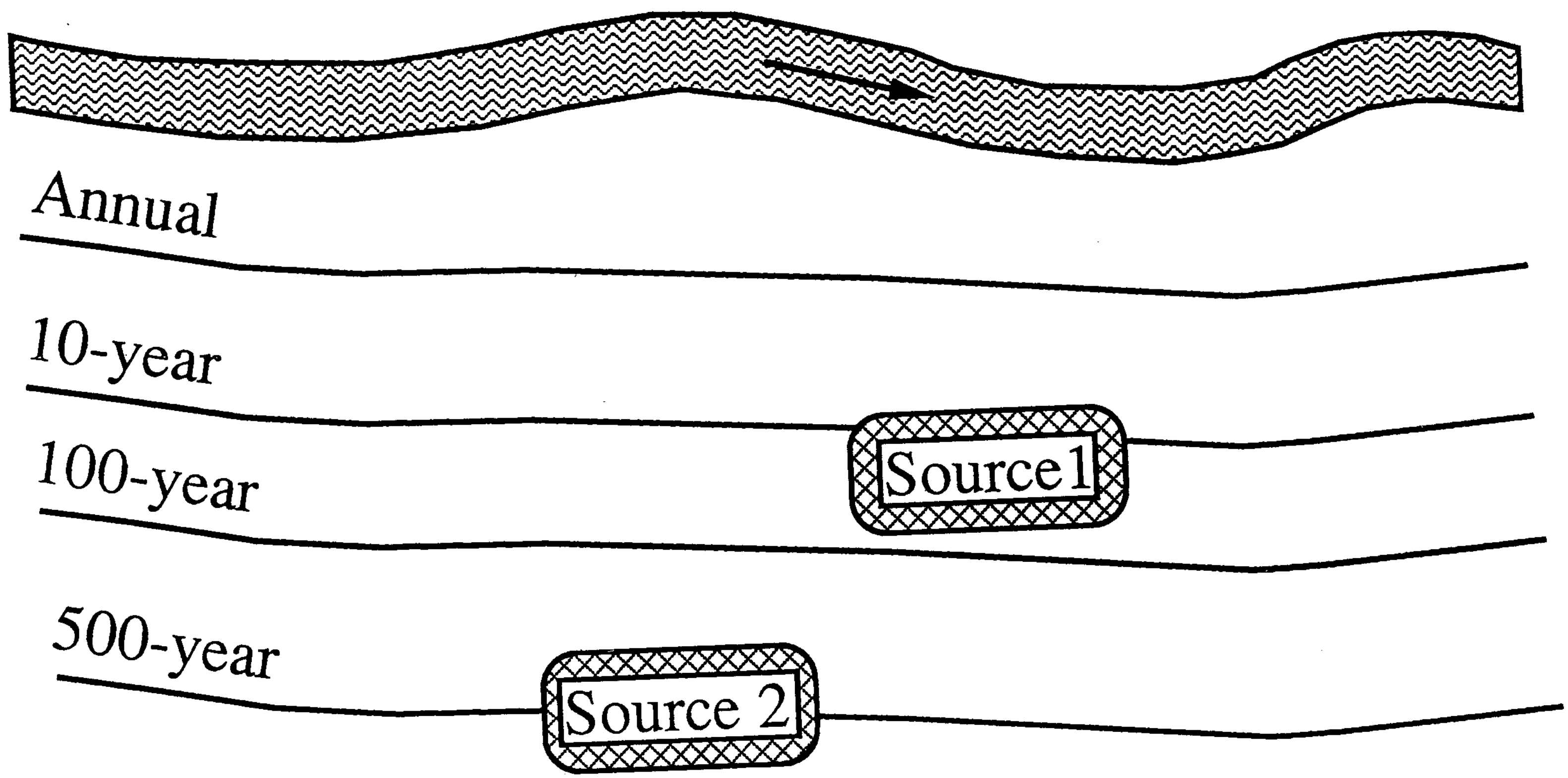
Distance to Surface Water

Please turn to the HRS rule,
table 4-7, page 51611.

- Measure the shortest overland segment, not a straight line distance.
- If the distance to surface water is greater than 2 miles, do not score potential to release by overland flow.

Please turn to the HRS rule,
table 4-1, page 51608.

Potential to Release by Flood



Potential to Release

Please turn to the HRS rule,
table 4-1, page 51608.

Exercise 6

Please turn to the Student Exercises, Exercise 6.

Section 12

Surface Water Pathway -

Drinking Water Threat

The Drinking Water Threat

- The drinking water threat is the first of the three threats in the overland flow/flood component of the surface water pathway.

Please turn to the HRS rule,
table 4-1, page 51608.

Waste Characteristics

- The waste characteristics factors are toxicity, persistence, and hazardous waste quantity.

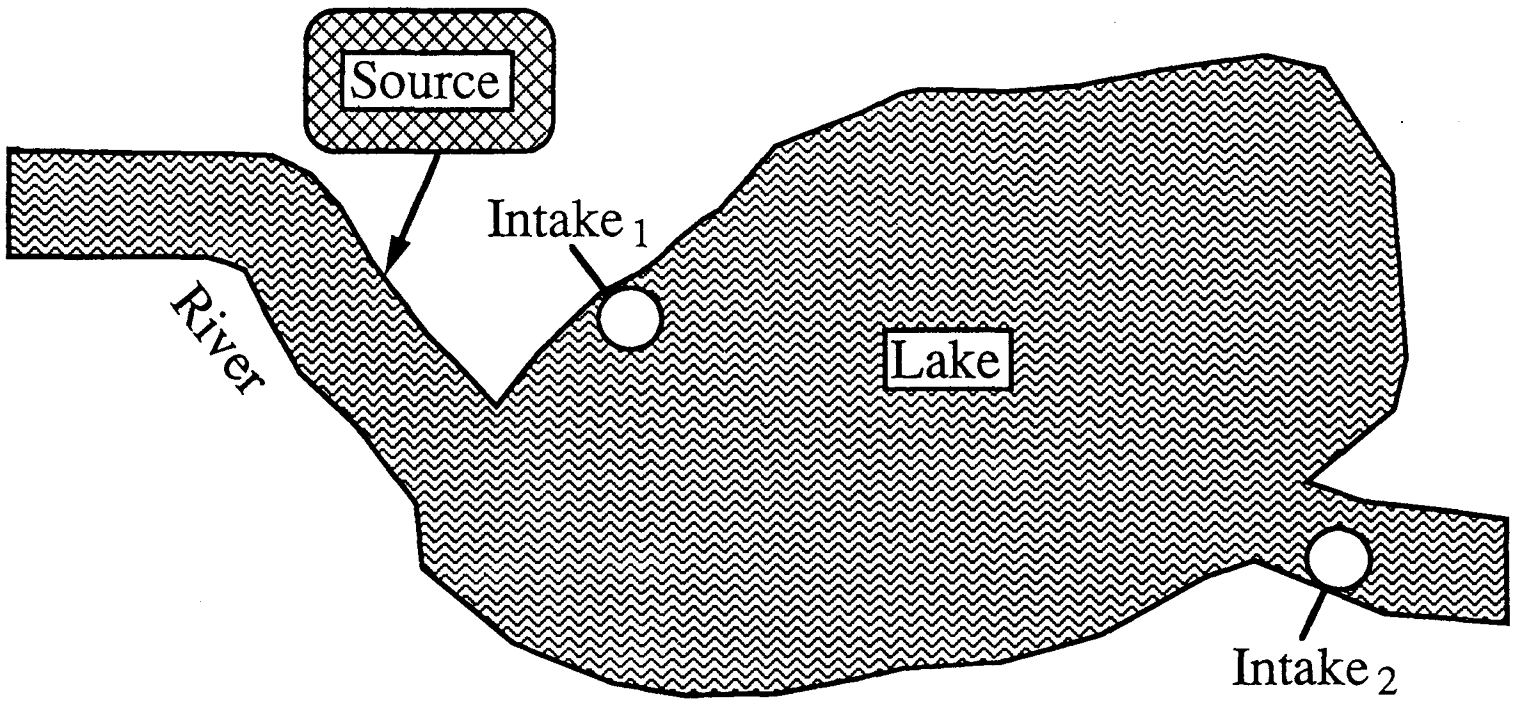
- Toxicity and hazardous waste quantity values are determined in the same manner as described previously.

Please turn to the LPQ SI report,
reference 2, page 38.

- Persistence is an indicator of the likelihood that a hazardous substance will degrade before reaching the TDL.

Please turn to the HRS rule,
table 2-7, page 51592.

Persistence



Targets

Please turn to the HRS rule,
table 4-1, page 51608.

- The nearest intake factor evaluates the maximally exposed individual drinking surface water.
- The population factor evaluates the number of residents, students, and workers served by surface water intakes within the TDL.
- Resources evaluates uses of surface water other than drinking.

Actual Contamination

- Actual contamination exists if a hazardous substance attributable to the site is documented at or beyond a drinking water intake.

- Once again, actual contamination is broken down into level I and level II contamination.

Please turn to the HRS Guidance Manual, page 251, highlight 8-27.

Potential Contamination

- Targets subject to potential contamination are evaluated using dilution weights based on the flow rates of surface water bodies.

Please turn to the HRS rule,
table 4-13, page 51613.

- Obtain flow rate data or estimate flow rates when data is unavailable or incomplete.

Please turn to the HRS Guidance Manual,
page 233, highlight 8-21.

Nearest Intake

- **Assign a value to the nearest intake factor based on level of contamination.**

Please turn to the HRS Guidance Manual, page 263, highlight 8-32.

Population

- The total target population (residents, students, and workers) is assigned a value based on the level of contamination for the intake.

  - Level I = n x 10

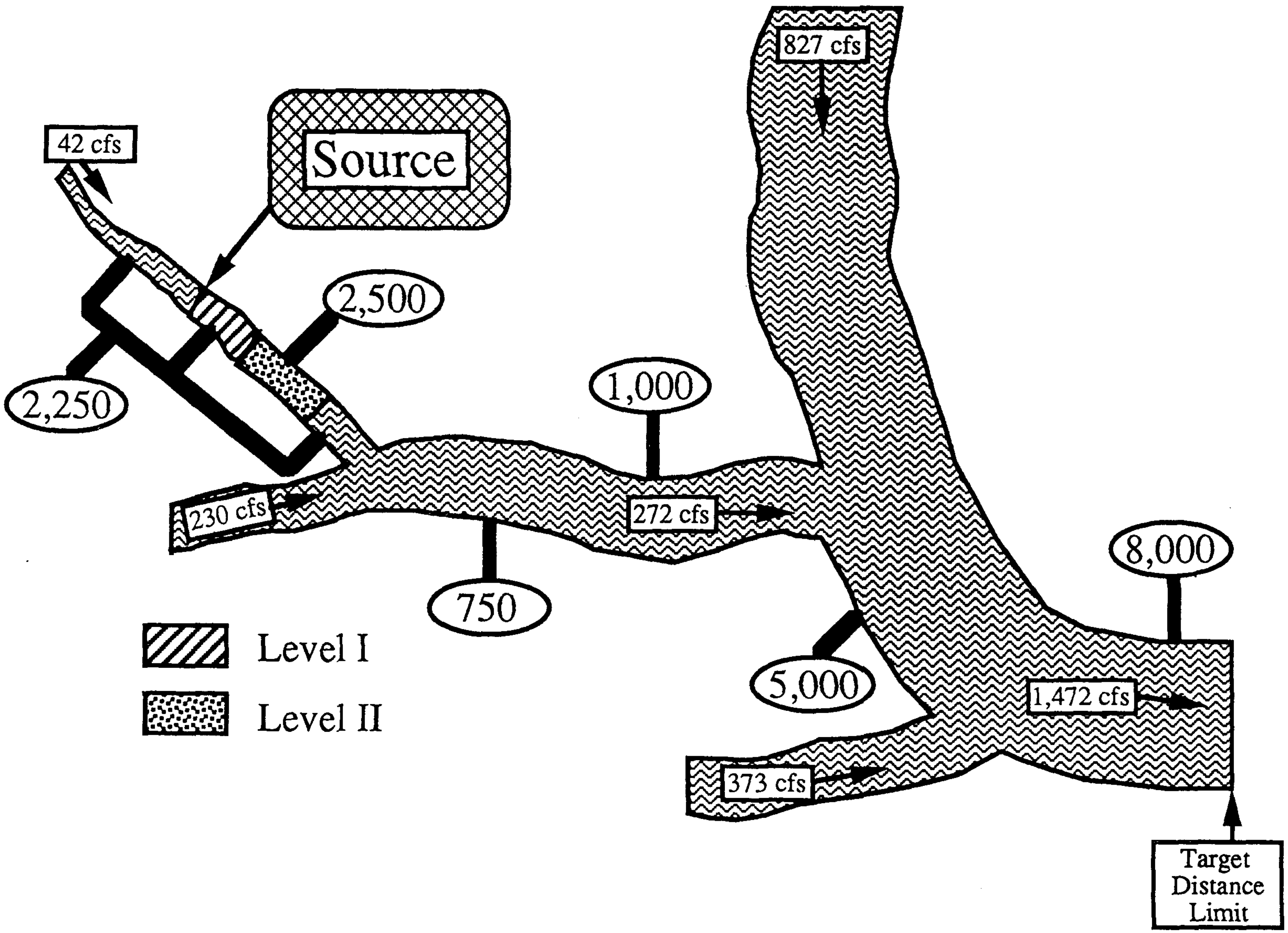
  - Level II = n x 1

  - Potential = dilution-weighted n x 0.1

- The population subject to potential contamination is dilution-weighted based on stream flow rates.

Please turn to the HRS rule,
table 4-14, page 51615.

Population (Concluded)



Resources

Please turn to the HRS Guidance Manual, page 290, highlight 8-45.

Please turn to the HRS rule, table 4-1, page 51608.

Efficiency of Scoring the Drinking Water Threat

Please turn to the HRS Guidance Manual, page 253.

Section 13

Surface Water Pathway -

Human Food Chain Threat

The Human Food Chain Threat

Please turn to the HRS rule,
table 4-1, page 51608.

Please turn to the HRS Guidance Manual,
page 293.

Documenting Presence of a Fishery

- Document that human food chain organisms are present in the fishery.
- Document that some attempt has been made to remove those organisms for human consumption.

Waste Characteristics

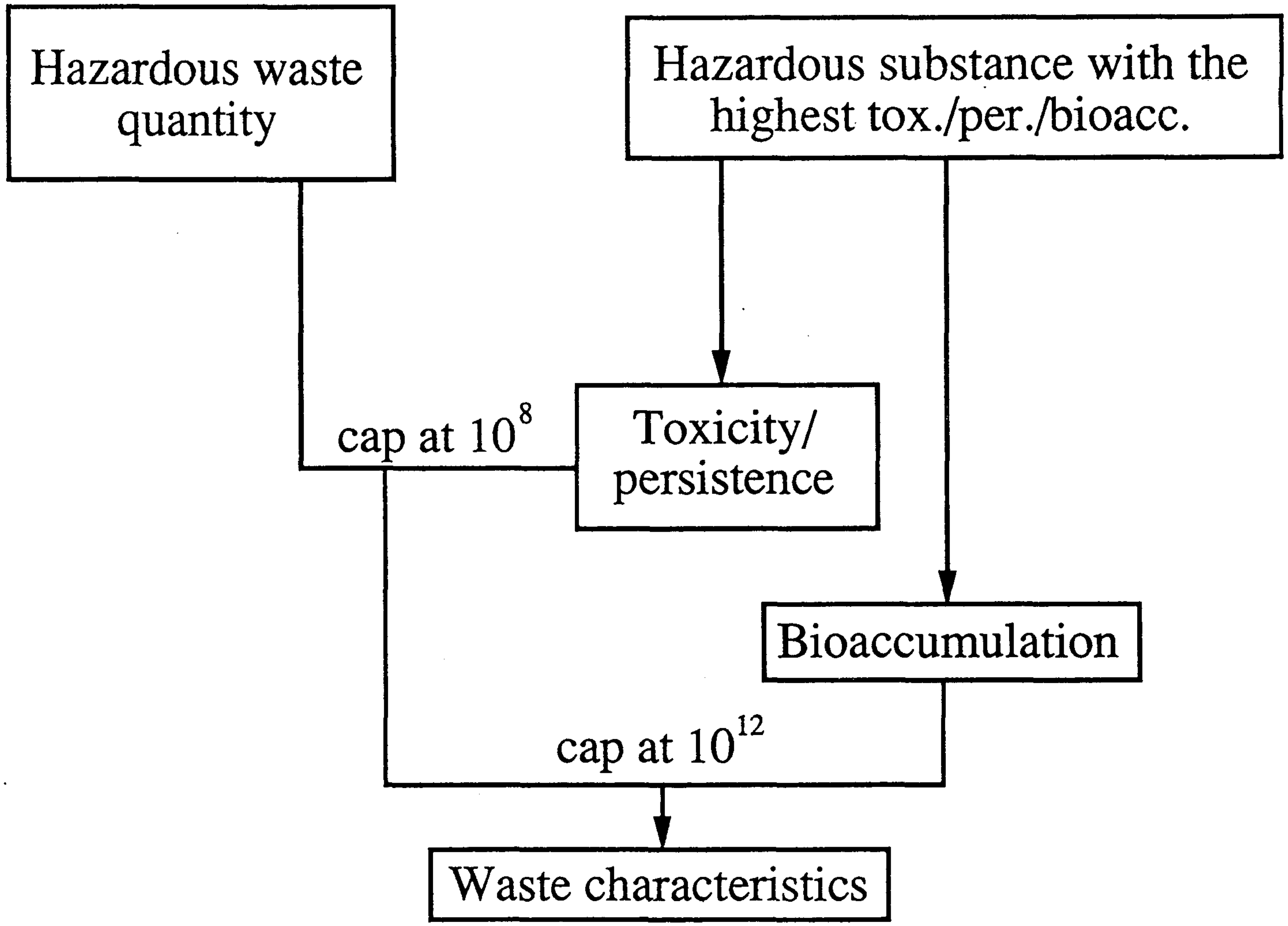
Please turn to the HRS rule, table 4-1, page 51608.

Waste Characteristics (Continued)

- The bioaccumulation potential factor evaluates the tendency of a substance to accumulate in the tissues of aquatic human food chain organisms.

Please turn to the LPQ SI report,
reference 2, page 38.

Waste Characteristics (Concluded)



Targets

- Targets consists of two factors; food chain individual and population.

    - Both factors are evaluated based on the level of contamination to which each fishery is subject (level I, level II, or potential).

- Determine if fisheries are subject to actual or potential contamination.

- Define fishery boundaries at any point where one of the following changes:

    - the dilution category,
    - the food chain production per acre,
    - the species harvested, or
    - the level of contamination.

Actual Contamination

- The human food chain threat evaluates the actual contamination of human food chain organisms, not the contamination of surface water or sediments.

  - Actual contamination is based on documentation that such contamination is likely or has occurred.

Please turn to the HRS Guidance Manual, page 298.

- Tissue samples of sessile, benthic organisms consumed by people can document actual contamination in a fishery.

  - Sediment and surface water samples must meet additional requirements that show contamination of a human food chain is likely.

Level of Contamination

- Establish zones of contamination based on level I, II, and potential sampling locations.
- Tissue samples are required to establish level I concentrations.

Please turn to the HRS Guidance Manual, page 299, highlight 8-48.

Food Chain Individual

- This factor value often drives the score for the human food chain threat.

Please turn to the HRS Guidance Manual, page 301, highlight 8-50.

- Because the bioaccumulation factor value usually raises the waste characteristics factory category value, a relatively low target value can result in high threat score.

Food Chain Population

Please turn to the HRS rule,
table 4-18, page 51621.

Please turn to the HRS Guidance Manual,
page 301, highlight 8-50.

Estimating Fishery Production

- Human food chain production can be estimated based on production data or, in some cases, stocking rate data.

Please turn to the HRS rule, table 4-18, page 51621.

Please turn to the HRS Guidance Manual, page 307, highlight 8-52.

Human Food Chain Threat Score

Please turn to the HRS rule,
table 4-1, page 51608.

Exercise 7

Please turn to the Student Exercises, Exercise 7.

Section 14

Surface Water Pathway - Environmental Threat

Overview of the Environmental Threat

Please turn to the HRS rule, table 4-1, page 51608.

Ecosystem Toxicity

Please turn to the LPQ SI report,
reference 2, page 38.

- Select the appropriate salt or fresh water ecosystem toxicity factor value from SCDM.

Please turn to the HRS Guidance Manual,
page 239.

- If environmental targets are in both fresh and salt water, or if any are in brackish water, assign the higher of the two ecosystem toxicity factor values.

- If SCDM only contains one ecosystem toxicity factor value (fresh or salt), use it.

Persistence

- The persistence factor value is calculated in the same way as for the previous threats, but you may get a different value.

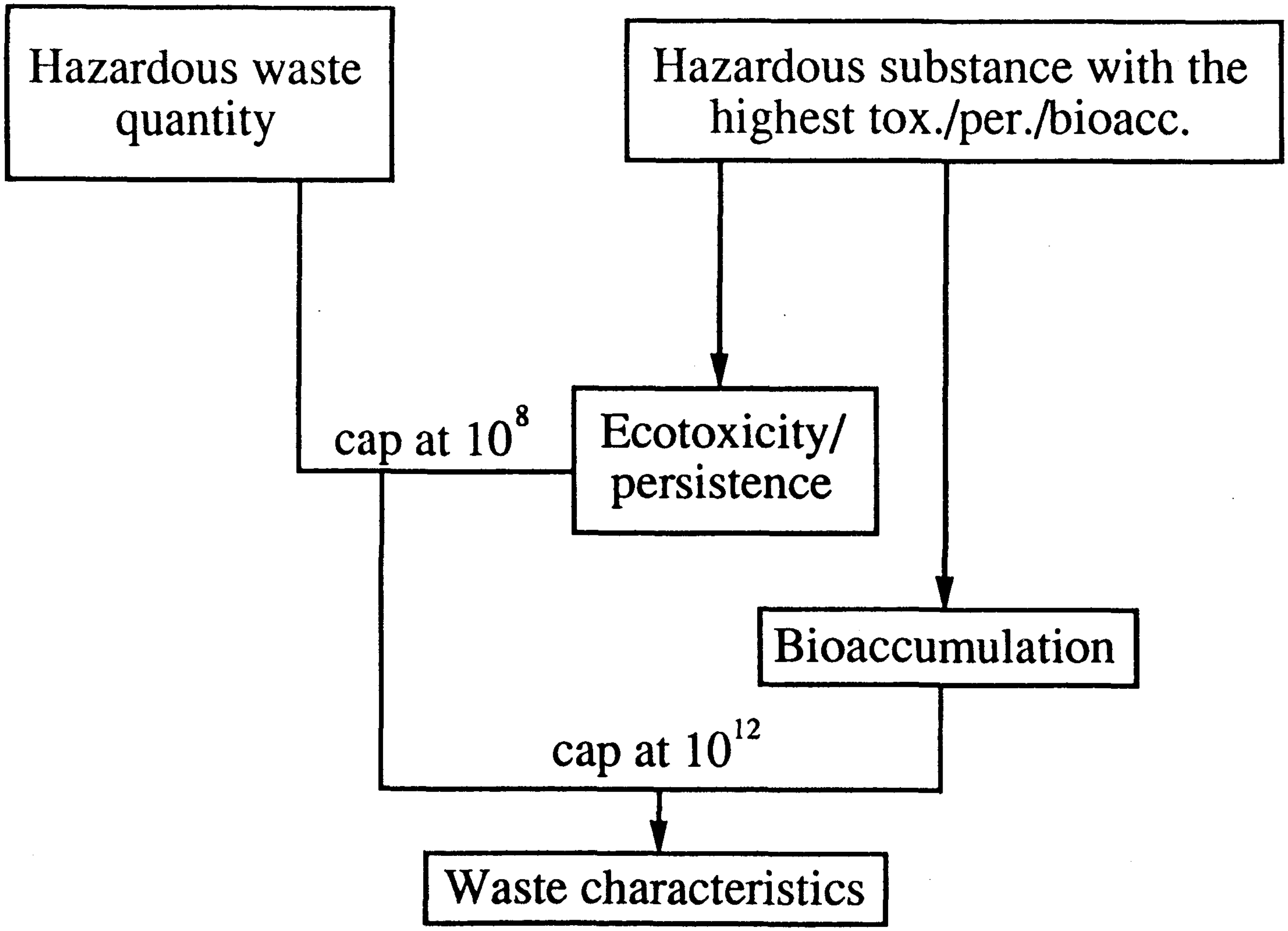
- Base your choice of river or lake persistence on the predominant surface water body type between the PPE and the nearest downstream target.

Bioaccumulation

- The bioaccumulation factor values for the environmental threat may differ from those for the human food chain threat.
  - Environmental threat bioaccumulation factor values are based on all aquatic organisms, not just human food chain organisms.
- Choose the appropriate fresh or salt water bioaccumulation factor value from SCDM based on the locations of sensitive environments.

Please turn to the LPQ Auto Parts SI report, reference 2, page 38.

Waste Characteristics Factor Value



Environmental Targets

- There are two types of environmental threat targets; wetlands, and the sensitive environments listed in HRS table 4-23.

Please turn to the HRS rule,
table 4-24, page 51625.

Please turn to the HRS rule,
table 4-23, page 51624.

Sensitive Environments

- Evaluate only those sensitive environments that lie in or along the in-water segment and could be impacted by the presence of contamination in the surface water body.

Please turn to the HRS Guidance Manual, Appendix A, page A-6.

Wetlands

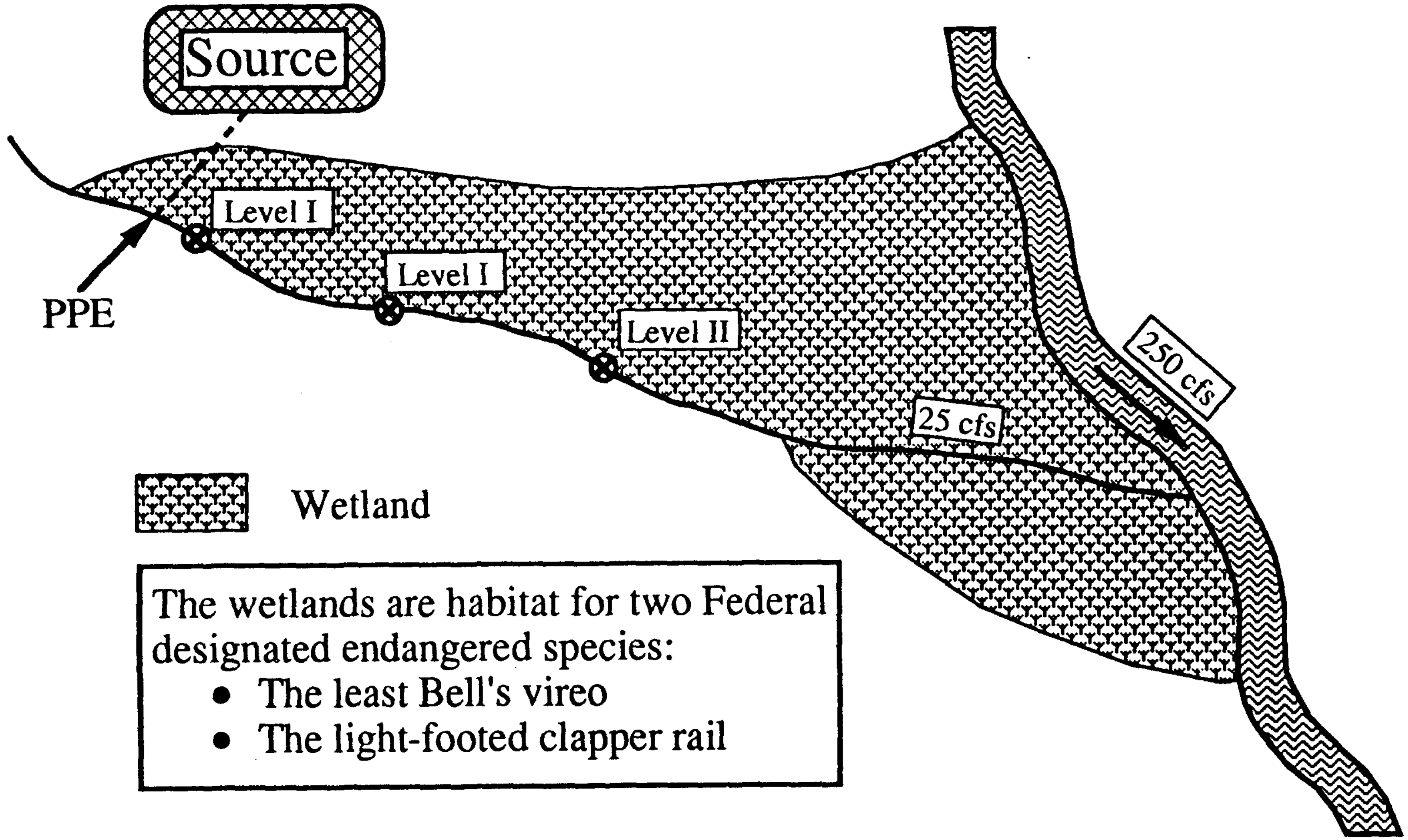
Please turn to the HRS Guidance Manual, section 8.16, page 331.

- Identify and determine the frontage of the wetland.
  - Delineate the boundaries of the wetland.
  - Establish whether to use the wetland frontage or perimeter to determine the wetland length.
- Segregate the wetland frontage (or perimeter) based on level of contamination (actual or potential) and, for potential, by dilution weights.

Sensitive Environments and Wetlands

- Sensitive environments listed in HRS table 4-23 are treated as indivisible between levels of contamination and dilution weights.
  - Point values are assigned based on the highest-scoring surface water segment within the sensitive environment.
- Wetland frontage is divisible between levels of contamination.
  - Point values from table 4-24 are assigned based on the total length (frontage) of wetland within each zone of contamination.

Sensitive Environments and Wetlands (Concluded)



The wetlands are habitat for two Federal designated endangered species:

- The least Bell's vireo
- The light-footed clapper rail

Environmental Benchmarks

Please turn to the LPQ Auto Parts SI report, reference 2, page 37.

- SCDM contains two EPA environmental benchmarks for the surface water pathway.
  - Ambient Water Quality Criteria (AWQC).
  - Ambient Aquatic Life Advisory Concentrations (AALAC).
- Select the appropriate salt or fresh water benchmark concentration, based on the surface water salinities at the target locations.
- Environmental benchmarks are based on aqueous concentrations. Therefore, aqueous samples are required for comparison.

Environmental Threat

Please turn to the HRS rule,
table 4-1, page 51608.

Exercise 8

Please turn to the Student Exercises, Exercise 8.

Section 15

Surface Water Pathway -

Ground Water to Surface Water Component

Overview and Definition

- The ground water to surface water component evaluates the likelihood of contaminants in the ground water discharging to surface water and affecting surface water targets.

- Either the overland flow/flood component or the ground water to surface water component is scored for the surface water pathway.

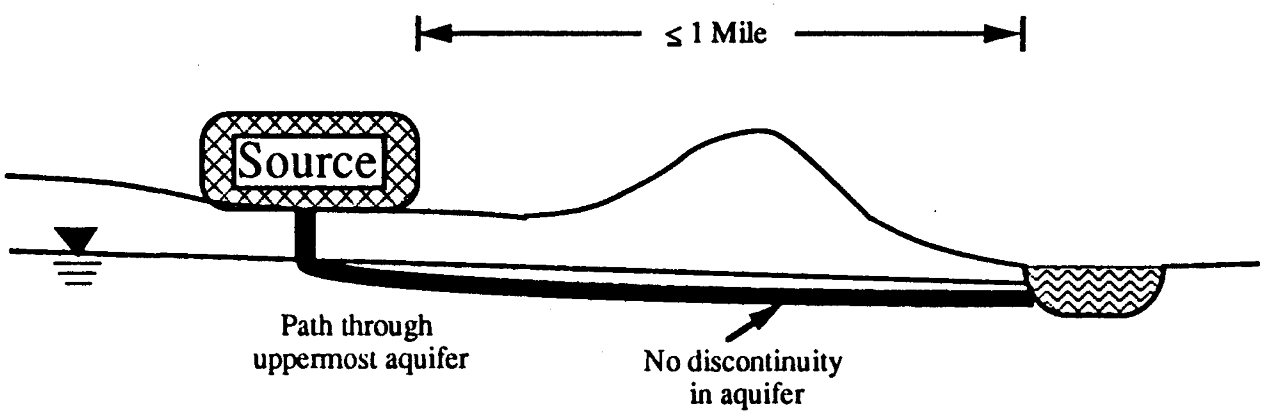
  - The two components are not additive; the highest scoring component is selected to score the pathway.

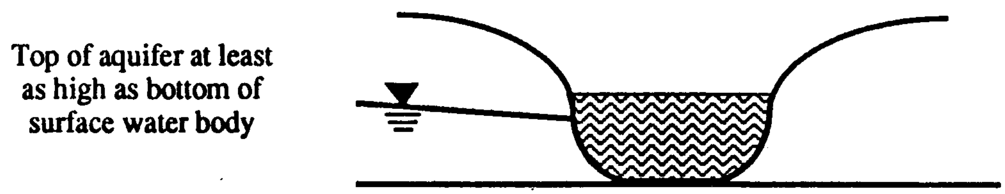
Please turn to the HRS rule,
table 4-25, page 51628.

Overview and Definition (Concluded)

- The ground water to surface water component can be scored only if certain criteria are met.

Please turn to the HRS rule, section 4.2.1.1, page 51626.





Hazardous Substance Migration Path

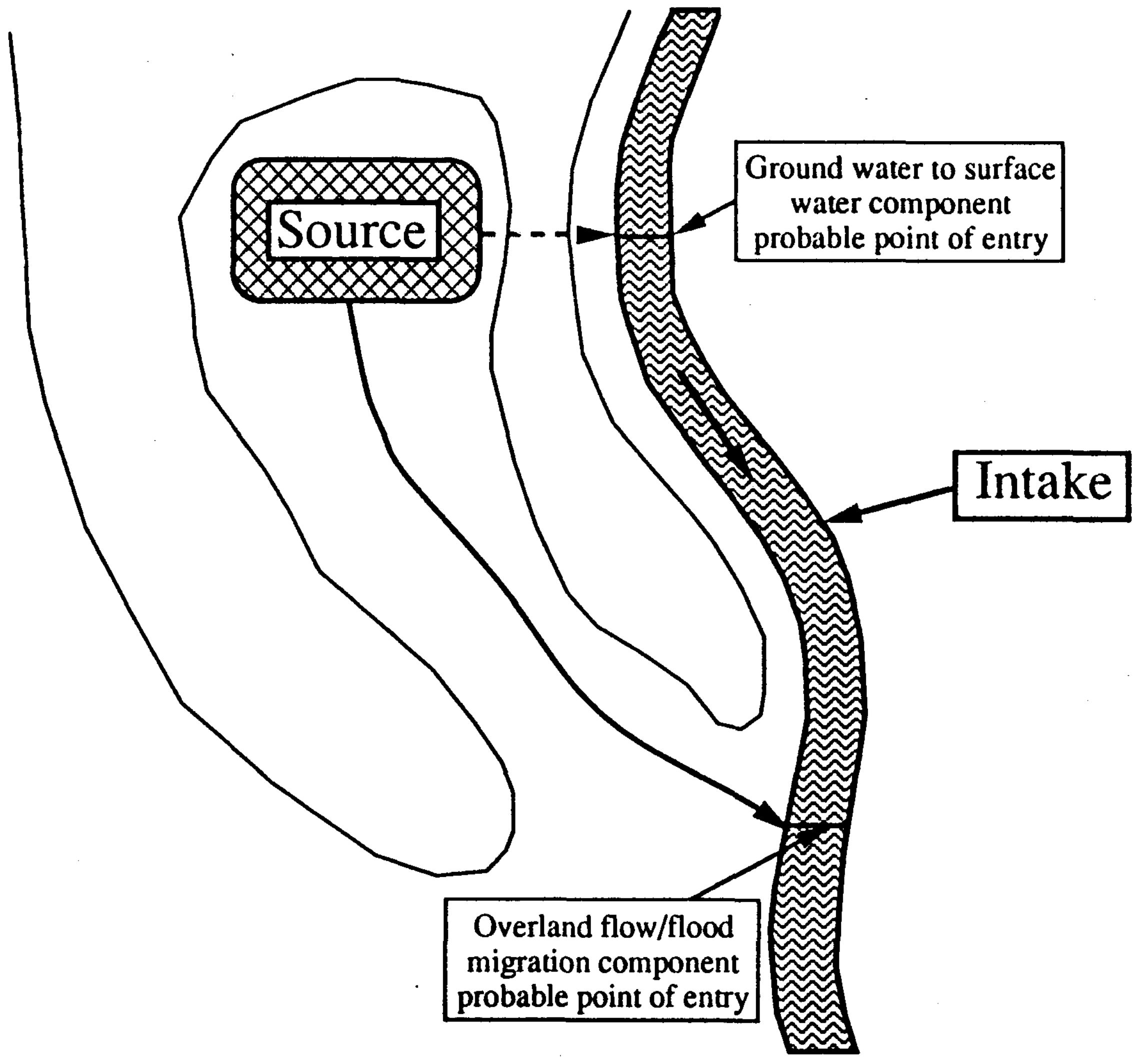
- The ground water segment is restricted to the uppermost aquifer and replaces the overland segment in the overland flow/flood component.

- The ground water segment is the shortest straight-line distance from a source to a surface water body.

- The probable point of entry may be different than it is for the overland flow/flood component.

  - Therefore, the 15-mile target distance limit may begin at a different point, and different targets may be evaluated.

Hazardous Substance Migration Path (Concluded)



Likelihood of Release

- Likelihood of release is evaluated in the same manner as for the ground water pathway.

    - Except, likelihood of release is evaluated only to the uppermost aquifer.

Please turn to the HRS rule,
table 4-25, page 51628.

Waste Characteristics

- **Both ground water mobility and surface water persistence are considered as threat-reducing mechanisms in this component and are multiplied.**

Toxicity x Ground Water Mobility x Surface Water Persistence

	Toxicity	Mobility	Persistence
Chromium (VI)	10,000	0.01 (liquid)	1
TCE	10	1	0.4
PCBs	10,000	0.0001 (liquid)	0.7 (lake)

Waste Characteristics (Concluded)

Please turn to the HRS rule,
table 4-25, page 51628.

- Only substances available to ground water are evaluated.
  - Found in a source with non-zero ground water containment.
  - Documented in an observed release to ground water.

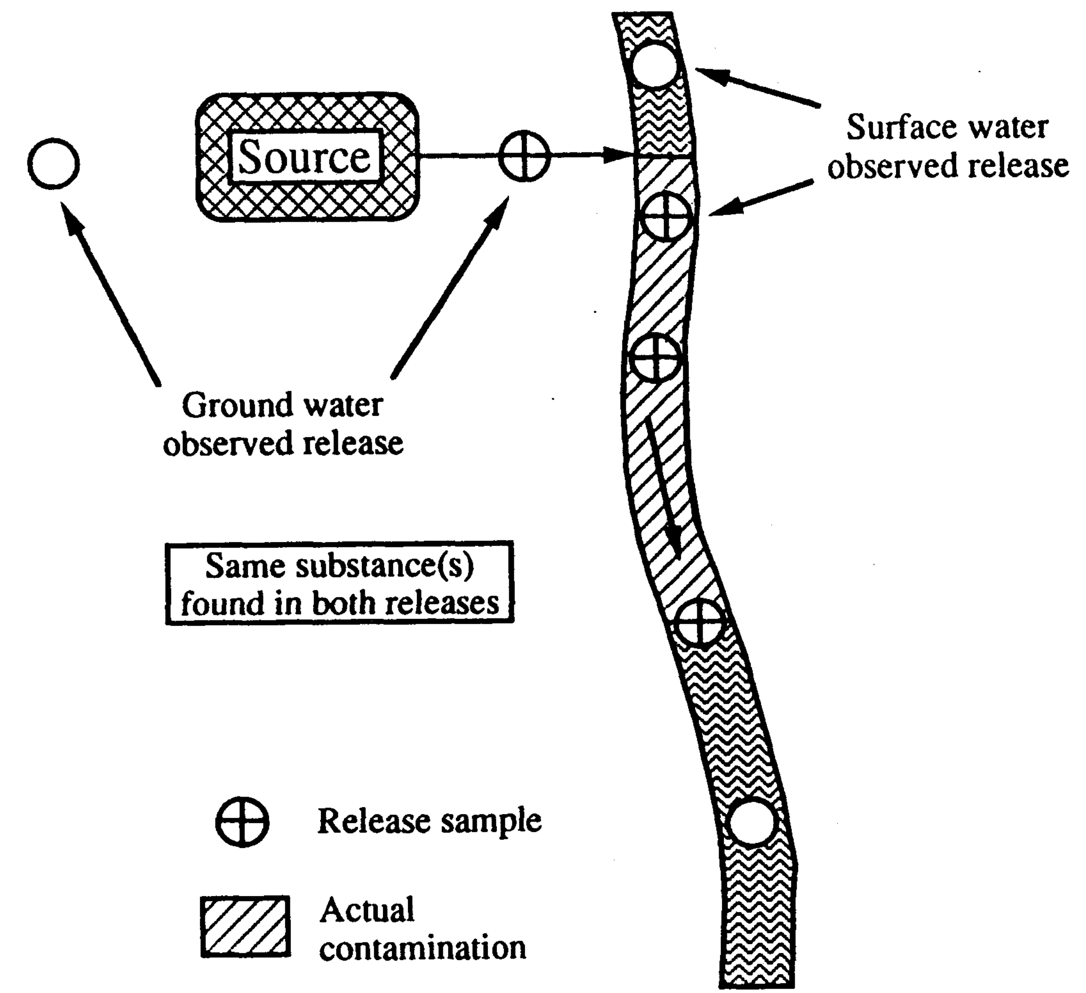
Actual Contamination of Targets

- The ground water to surface water component evaluates the same surface water targets factors as the overland flow/flood component.
  - If the PPE changes, the actual targets evaluated may be different.

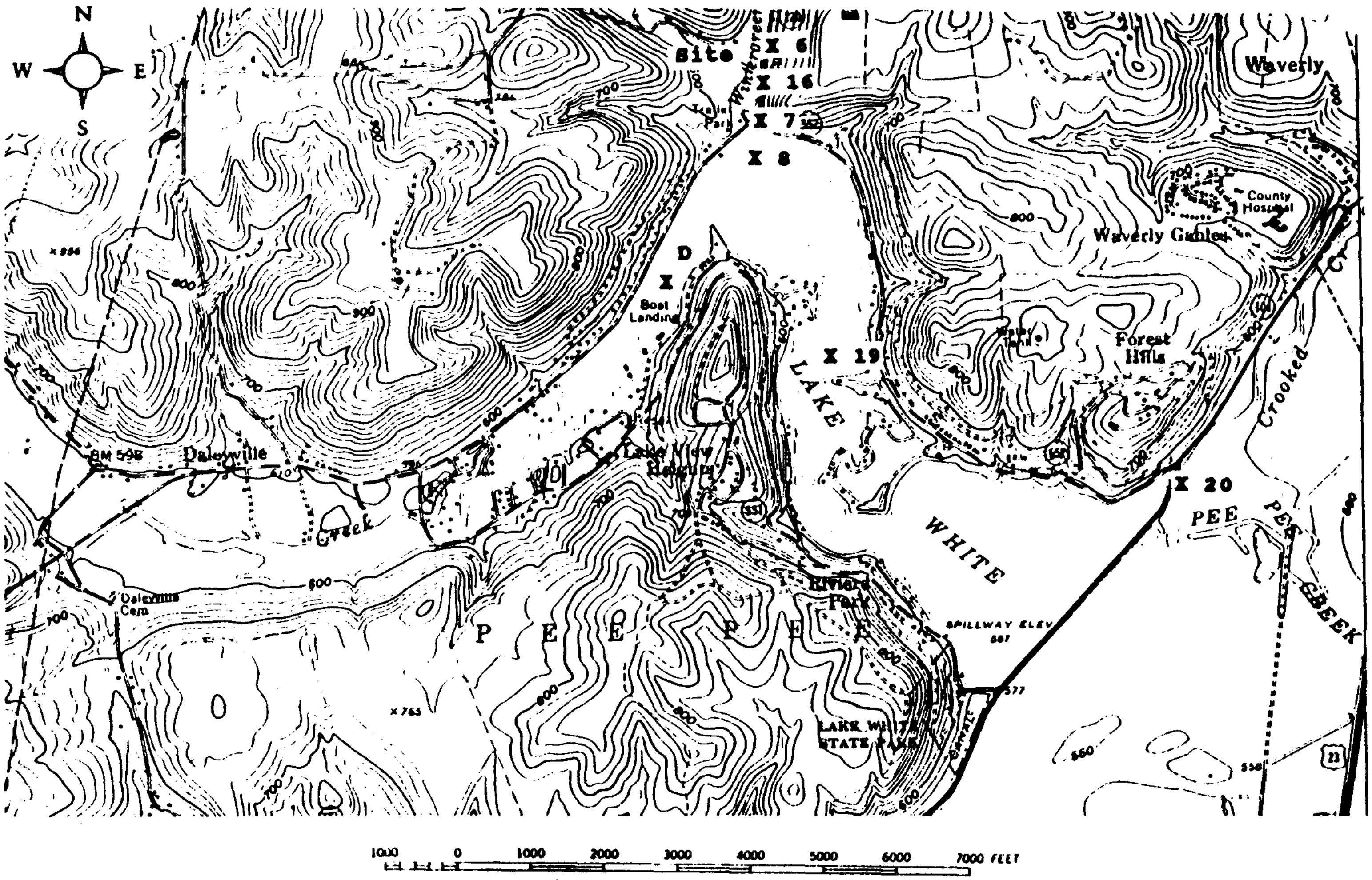
Please turn to the HRS rule,
section 4.2.1.3, page 51626.

- Substances used to establish actual contamination of targets must be found in both an observed release to ground water and an observed release to surface water by chemical analysis (not by direct observation).
- Determine level of contamination by comparison to appropriate surface water benchmarks.

Actual Contamination of Targets (Continued)



Actual Contamination of Targets (Concluded)



Potential Contamination of Targets

Please turn to the HRS rule,
figure 4-3, page 51632.

- The dilution weights for all potentially-contaminated targets are multiplied by an adjustment factor based on the angle theta.
- The HRS model assumes that ground water flows out from sources equally in all directions.
- Only that portion of ground water that intersects with surface water within a 1-mile distance limit is considered in the evaluation of the angle theta.

Please turn to the HRS rule,
table 4-27, page 51631.

Section 16

Air Pathway -

Likelihood of Release

The Air Pathway

LIKELIHOOD OF RELEASE		WASTE CHARACTERISTICS		TARGETS
Observed Release or Potential to Release Gas Gas Containment Gas Source Type Gas Migration Particulate Particulate Containment Particulate Source Type Particulate Migration	x	Toxicity/Mobility Hazardous Waste Quantity	x	Nearest Individual Population Resources Sensitive Environments

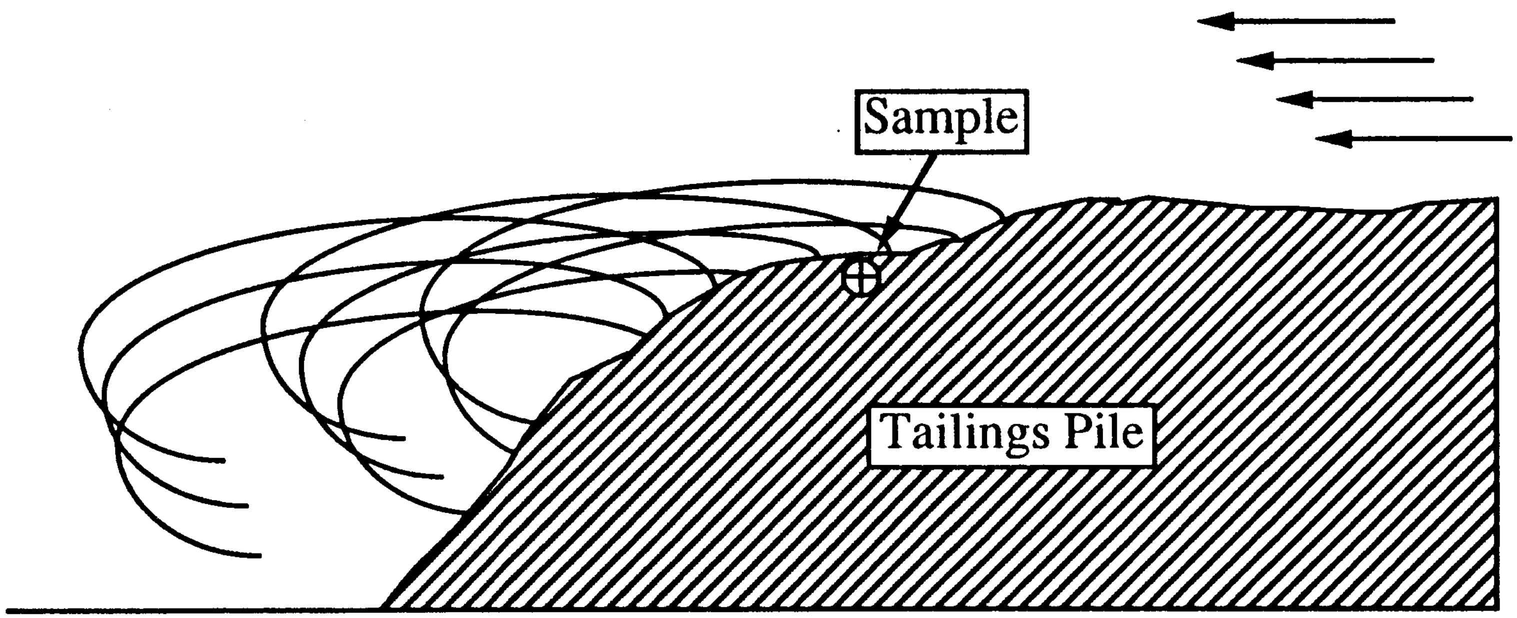
Likelihood of Release

Please turn to the HRS rule,
table 6-1, page 51651.

Observed Release by Direct Observation

- An observed release by direct observation can be documented when one of the following occurs:
  - Material that contains one or more hazardous substances has been seen entering the atmosphere directly.
  - Demonstrated adverse effects may establish an observed release when evidence supports the inference that a material containing hazardous substances has been released into the atmosphere.

Observed Release by Direct Observation
(Concluded)



Observed Release by Chemical Analysis

- An observed release to air by chemical analysis is documented when both of the following occur:

  - Analysis of air samples shows that the concentration of ambient hazardous substance(s) has increased significantly over background for the site.

  - Some portion of the release is attributable to a source at the site.

Please turn to the HRS Guidance Manual, page 400.

Gaseous and Particulate Substances

- Distinguish between gaseous substances (vapor pressure greater than or equal to 10^{-9} torr) and particulate substances (vapor pressure less than or equal to 10^{-1} torr).

Please turn to the HRS Guidance Manual,
page 405, highlight 10-2.

Please turn to the LPQ SI report,
reference 2, page 38.

Potential to Release

- In a single source there may be some substances that are gaseous, some substances that are particulate, and some that are both.
- The release of gaseous substances is governed by quite different factors than the release of particulate. Therefore, two separate evaluations are needed.
- Potential to release evaluates both the gas potential to release and the particulate potential to release, and selects the higher scoring of the two.

Please turn to the HRS rule, table 6-2, page 51651.

Please turn to the HRS rule, table 6-8, page 51653.

Containment

- The gas containment value is assigned from HRS rule table 6-3.

Please turn to the HRS rule,
table 6-3, page 51652.

- The particulate containment value is assigned from HRS table 6-9.

Please turn to the HRS rule,
table 6-9, page 51653.

- These tables require that specific observations are made during the site visit.

Please turn to the HRS Guidance Manual,
page 406.

Source Type

- Different source type factor values are assigned to gas and particulate potential from HRS table 6-4.

Please turn to the HRS rule,
table 6-4, page 51652.

- The minimum size requirement applies to source type rather than containment in the air pathway.

  - If a source does not meet the minimum size requirement (i.e., a hazardous waste quantity value of 0.5 or greater), assign that source a value of 0 for source type.

Gas Migration Potential

Please turn to the HRS rule,
table 6-6, page 51653.

- Obtain the gas migration potential values for each gaseous substances found in the source from SCDM.

- Average the three highest values.

- Assign a source gas migration potential to the source from HRS table 6-7.

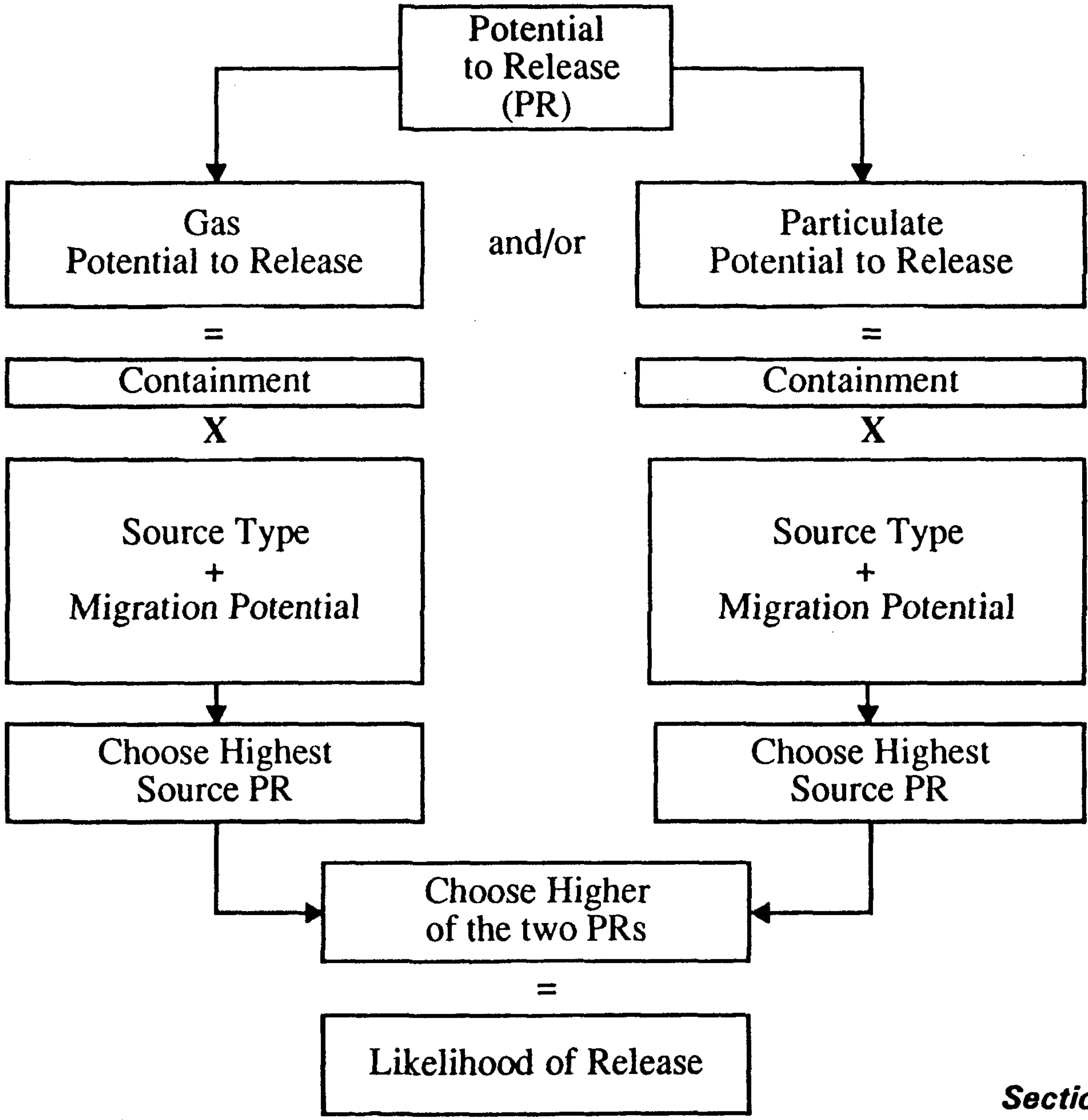
Particulate Migration Potential

- This value is the same for all sources at the site and is based on the location of the site.

Please turn to the HRS rule, figure 6-2, pages 51654-55.

- If the site is too near a breakpoint on the map, calculate the Thornthwaite precipitation-effectiveness index using mean monthly precipitation and mean monthly temperature data for the site.

Calculate Potential to Release



Exercise 9

Please turn to the Student Exercises, Exercise 9.

Section 17

Air Pathway -

Waste Characteristics and Targets

Waste Characteristics

Please turn to the HRS rule,
table 6-1, page 51651.

Toxicity and Mobility

- Obtain the toxicity factor value from SCDM.
- Assign a value of 1 for mobility for a gaseous substance found in an observed release by direct observation or by chemical analysis.
  - Otherwise, assign a gaseous mobility value found in SCDM.
- Assign a value of 0.02 for a particulate substance found in an observed release.
  - Otherwise, obtain a particulate mobility value from HRS rule figure 6-3.

Please turn to the HRS rule,
figure 6-3, pages 51657-60.

Waste Characteristics

- Select the most hazardous substance, the substance with the highest product of toxicity times mobility.

- Multiply toxicity/mobility by the value for the hazardous waste quantity for the air pathway.

  - This product is capped at 10^8.

Please turn to the HRS rule,
table 6-1, pages 51651.

- The waste characteristics value is obtained from HRS rule table 2-7. The maximum value is 100.

Targets

Please turn to the HRS rule,
table 6-1, page 51651.

Distance Categories

Please turn to the HRS Guidance Manual,
page 418, highlight 10-9.

- Level I is assigned to the entire distance category with the level I sample and to all closer distance categories.
- Level II is assigned to the entire distance category with the level II sample and to all closer distance categories that are not at level I.
- Potential contamination is assigned to all other distance categories within the target distance limit.

Please turn to the HRS Guidance Manual,
page 419, highlight 10-10.

Distance Categories (Concluded)

- The air pathway is unique in that an observed release and the corresponding zones of actual contamination are attributed to single source.

Please turn to the HRS Guidance Manual,
page 415, highlight 10-7.

Nearest Individual

Please turn to the HRS rule,
section 6.3.1, page 51661.

Population

- Count the number of residents, workers, and students (n) subject to each level of contamination.

  - Level I population = n x 10

  - Level II population = n x 1

  - Potential population = distance-weighted n x 0.1

Please turn to the HRS rule,
table 6-17, page 51661.

- Note in HRS rule table 6-17 that the first distance category is "On a source".

  - This could include workers whose duties take them onto a source and residents whose homes were built over an old source.

Resources

Please turn to the HRS rule,
page 51662.

Please turn to the HRS Guidance Manual,
page 422, highlights 10-11 and 10-12.

Please turn to the HRS Guidance Manual,
page 421.

- Note that the target distance limit for resources is 1/2 mile.

Sensitive Environments

- HRS rule table 4-23 lists the air sensitive environments.

Please turn to the HRS rule,
table 4-23, page 51624.

Please turn to the HRS Guidance Manual,
page 425, highlight 10-13.

- Wetlands are evaluated by acreage rather than frontage.

Please turn to the HRS rule,
table 6-18, page 51662.

Sensitive Environments (Continued)

- Only two contamination levels are assigned to sensitive environments.

  - *Actual contamination:* This is not further divided into level I and level II because there are no air benchmarks.
  - Potential contamination.

- The multipliers for the two contamination levels are:

  - Actual contamination values have a multiplier of 1.
  - Potential contamination values have a multiplier of 0.1 and are distance-weighted.

Please turn to the HRS rule,
table 6-15, page 51661.

Sensitive Environments (Continued)

- **When sensitive environment is in one or more distance category:**
  - **If the sensitive environment is not a wetland, assign it to the distance category closest to the source.**
  - **If the sensitive environment is a wetland, assign the acreage in each distance category (i.e., wetlands are divisible).**

Please turn to the HRS Guidance Manual, page 427, highlight 10-15.

Sensitive Environments (Concluded)

- The air pathway score based solely on sensitive environments is limited to 60 pathway points.

Please turn to the HRS rule,
section 6.3.4.3, page 51662.

Air Pathway (Concluded)

Please turn to the HRS rule,
table 6-1, page 51651.

Exercise 10

Please turn to the Student Exercises, Exercise 10.

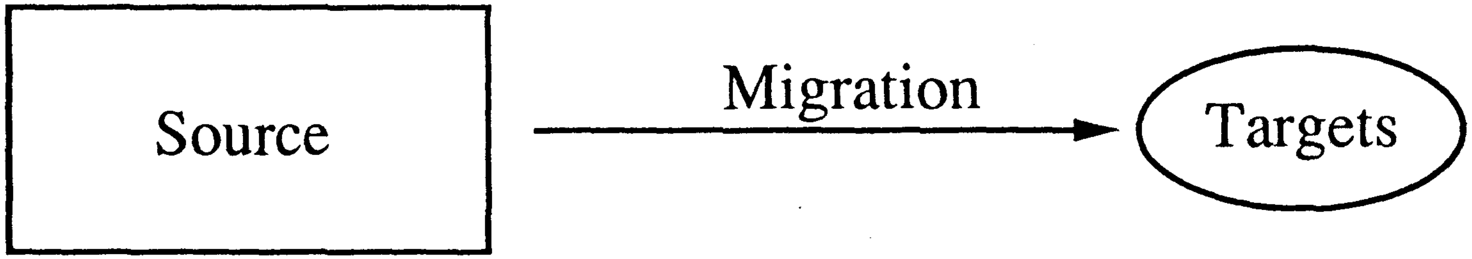
Section 18

Soil Exposure Pathway -

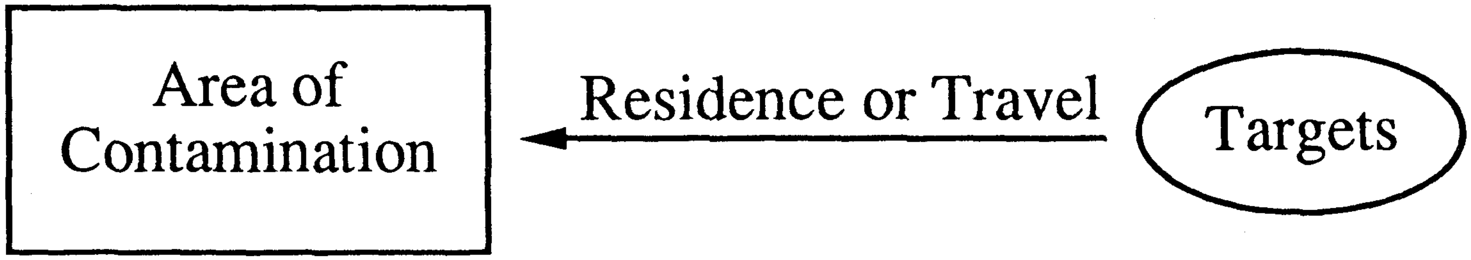
Resident Population Threat

Exposure vs. Migration

Migration Pathways:



Soil Exposure Pathway:



The Soil Exposure Pathway

RESIDENT POPULATION THREAT

LIKELIHOOD OF EXPOSURE		WASTE CHARACTERISTICS		TARGETS
Observed Contamination Area with Resident Targets	x	Toxicity Hazardous Waste Quantity	x	Resident Individual Resident Population Workers Resources Terrestrial Sensitive Enviroments

+

NEARBY POPULATION THREAT

LIKELIHOOD OF EXPOSURE		WASTE CHARACTERISTICS		TARGETS
Attractiveness/Accessibility Area of Contamination	x	Toxicity Hazardous Waste Quantity	x	Nearby Individual Population w/in 1 mile

Definitions

- **Observed contamination** -- Surficial contamination related to a site, as defined by a sampling location meeting observed release criteria. Analogous to observed release by chemical analysis in the migration pathways.

- **Area of observed contamination** -- Established based on sampling locations meeting observed release criteria. Analogous to a source in the migration pathways.

- **Likelihood of exposure** -- Analogous to likelihood of release in a migration pathway.

- **Resident population threat** -- Evaluates targets located on areas of observed contamination. Analogous to targets exposed to actual contamination in the migration pathways.

- **Nearby population threat** -- Evaluates targets that may potentially migrate to an area of observed contamination. Analogous to potential contamination in the migration pathways.

Observed Contamination

Please turn to the HRS rule,
section 5.0.1, page 51646.

- The observed contamination criteria are the same as the criteria for establishing an observed release by chemical analysis in the migration pathways.

- Establish a site-specific background level.

Please turn to the HRS Guidance Manual,
page 344, highlight 9-1.

Areas of Observed Contamination

- Identify sampling locations that meet the observed contamination criteria.

- For sources other than contaminated soil (if boundaries are well-defined), consider the entire source to be an area of observed contamination if any sampling location within that source meets the criteria for observed contamination.

Please turn to the HRS Guidance Manual, page 345, highlight 9-2.

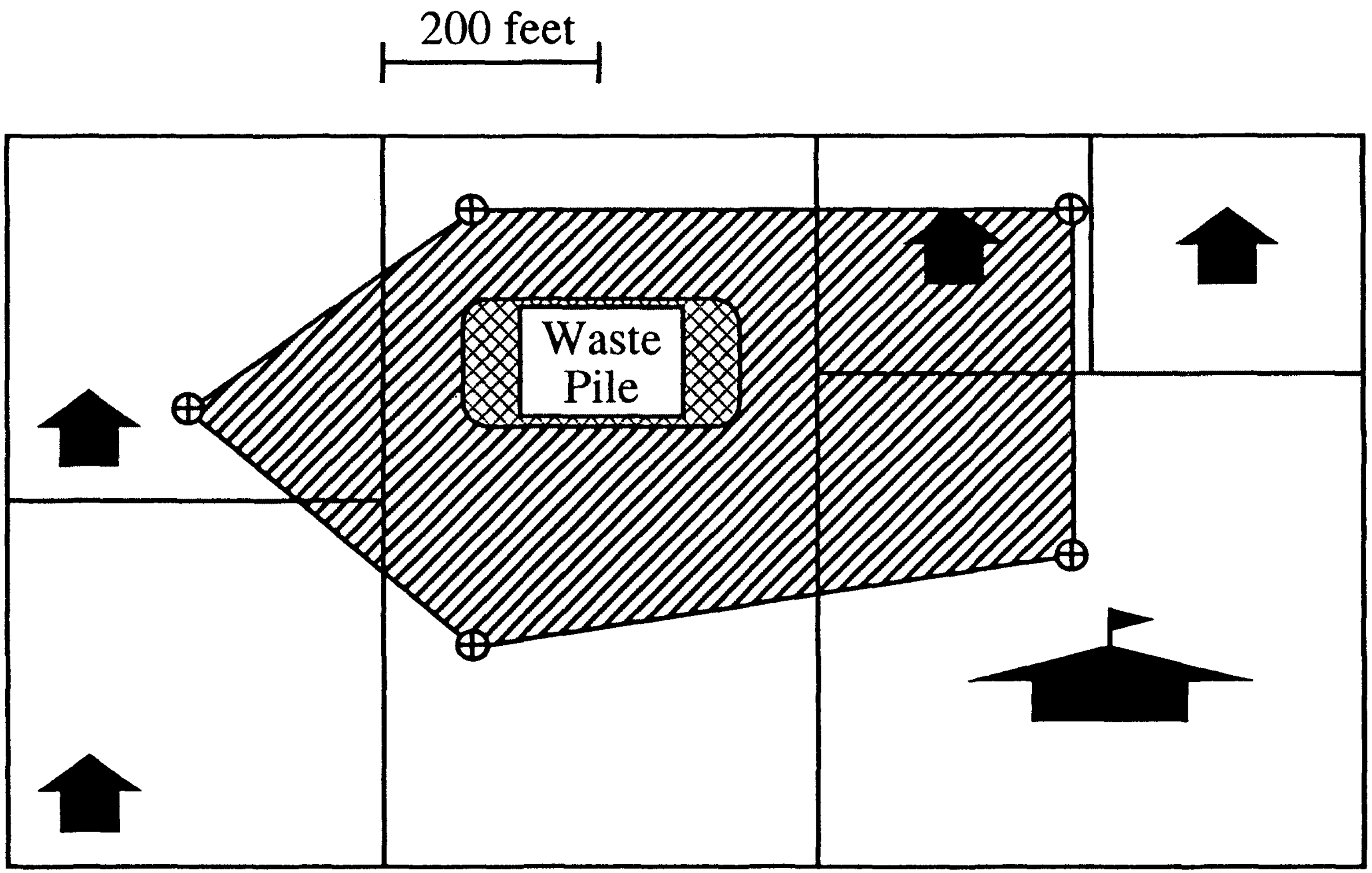
- For contaminated soils, consider observed contamination sampling locations and the area between such locations to be areas of observed contamination, unless available information indicates otherwise.

Areas of Observed Contamination (Continued)

- **Refine the areas of observed contamination.**

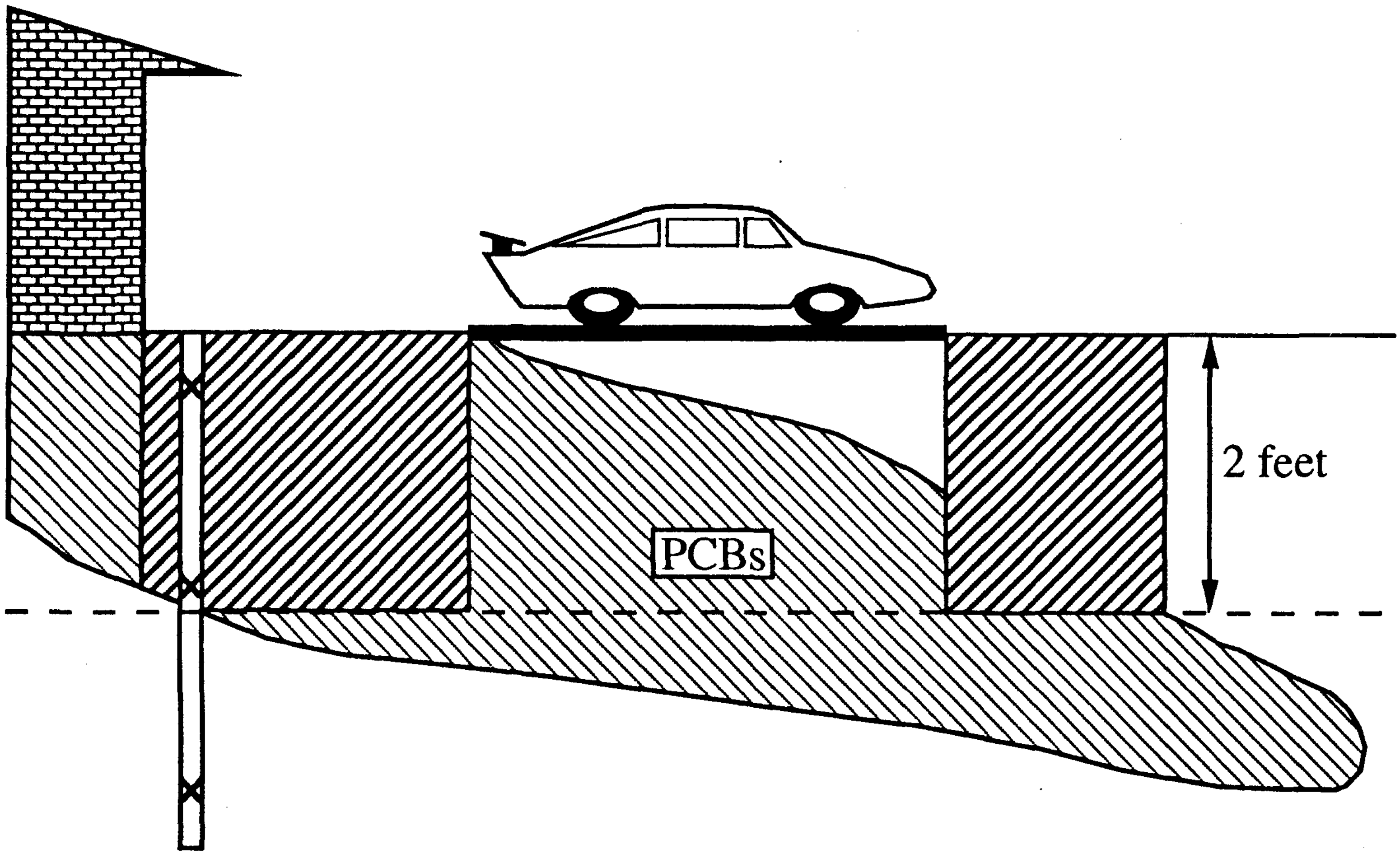
Please turn to the HRS Guidance Manual, page 349, highlight 9-6.

Areas of Observed Contamination (Continued)



Areas of Observed Contamination (Concluded)

Observed contamination can only be established for the shaded areas



Resident Population Threat

Please turn to the HRS rule,
table 5-1, page 51646.

Likelihood of Exposure

- Assign a likelihood of release value of 550 if an area of observed contamination is located on the same property and within 200 feet of a residence, a school or day care center, or a workplace area.

- Assign a likelihood of release value of 550 if an area of observed contamination is within the boundaries of a resource (as specified in HRS section 5.1.3.4) or a terrestrial sensitive environment (as specified in HRS section 5.1.3.5).

- Otherwise, assign a likelihood of release value of 0 for the resident population threat and move on to the nearby population threat.

Waste Characteristics

- The waste characteristics factors are toxicity and hazardous waste quantity.

- For hazardous waste quantity in the soil exposure pathway, areas of observed contamination are evaluated rather than sources.

Please turn to the HRS rule,
table 5-2, page 51647.

- Consider only the top 2 feet of an area of observed contamination, except as specified for the volume measure (tier C).

Please turn to the HRS Guidance Manual,
page 354, highlight 9-7.

Targets

- **Resident population threat targets consist of resident individual, resident population, workers, resources, and terrestrial sensitive environments.**

Please turn to the HRS Guidance Manual, page 359, highlight 9-8.

Level of Contamination

- The resident population threat only evaluates targets subject to actual contamination. Do not evaluate potential targets under this threat.

- Compare the concentration of each hazardous substance that meets the observed contamination criteria with its benchmark for the pathway.

  - Soil exposure pathway benchmarks are contained in SCDM.

Please turn to the HRS Guidance Manual, page 367, highlight 9-10.

Resident Individual

- A resident individual is any person who lives or attends school or day care on a property with an area of observed contamination and whose residence, school, or day care is on or within 200 feet of an area of observed contamination.

- Do not count workers as resident individuals.

- Determine the level of contamination (I or II) to which each resident individual is subject.

- Score the resident individual factor based on the highest-scoring resident individual.

Resident Population

- The resident population factor value is based on the number of resident individuals (n) subject to level I and level II concentrations.

- Level I = n x 10.

- Level II = n x 1.

Workers

- Workers are people whose workplace is on the same property as, and within 200 feet of, an area of observed contamination.

  - Count both full and part-time workers, but not temporary or transient workers.

Please turn to the HRS rule,
table 5-4, page 51647.

Resources

Please turn to the HRS rule,
section 5.1.3.4, page 51647.

Terrestrial Sensitive Environments

Please turn to the HRS Guidance Manual, page 376.

Please turn to the HRS Guidance Manual, page 380, highlight 9-16.

Please turn to the HRS Guidance Manual, page 379, highlight 9-15.

Resident Population Threat SI Strategy

- The primary objective of the soil exposure pathway is to identify whether residential or school properties are contaminated.

- A secondary objective is to document observed contamination within the property of a workplace, or within the boundaries of a terrestrial sensitive environment or resource.

- Before scoping out sampling strategies, look for corroborative information such as:
  - Data from other investigations.
  - Historical waste deposition patterns.
  - Soil staining and stressed vegetation.
  - Site drainage patterns.

- Remember only level II contamination of targets can be inferred between sampling points.

Score the Resident Population Threat

Please turn to the HRS rule,
table 5-1, page 51646.

Exercise 11

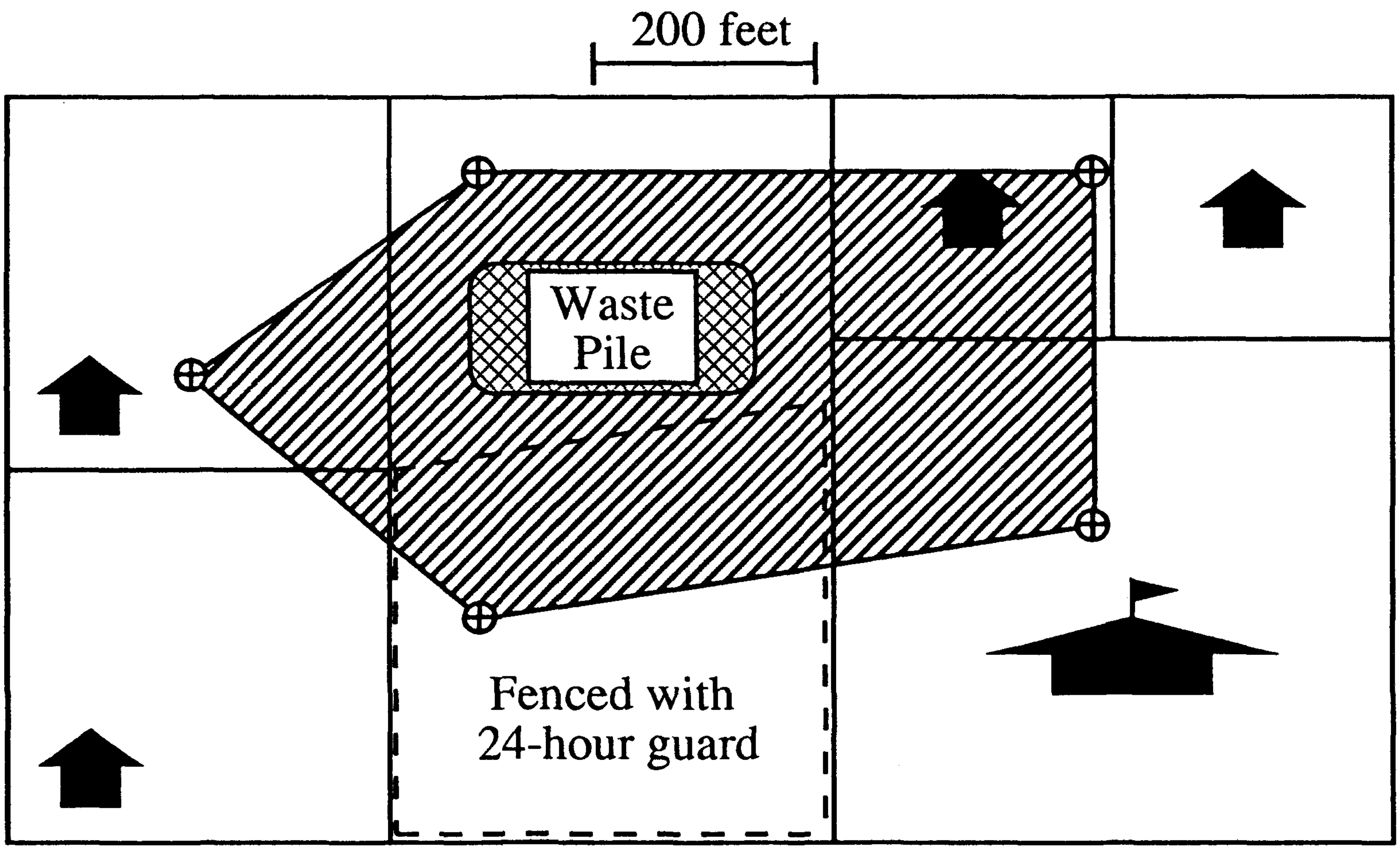
Please turn to the Student Exercises, Exercise 11.

Section 19

Soil Exposure Pathway -

Nearby Population Threat

Nearby Population Threat



Nearby Population Threat (Concluded)

Please turn to the HRS rule, table 5-1, page 51646.

Likelihood of Exposure

- Assign an attractiveness/accessibility factor value to each area of observed contamination, excluding any land used for residences.

Please turn to the HRS rule,
page 51648, table 5-6.

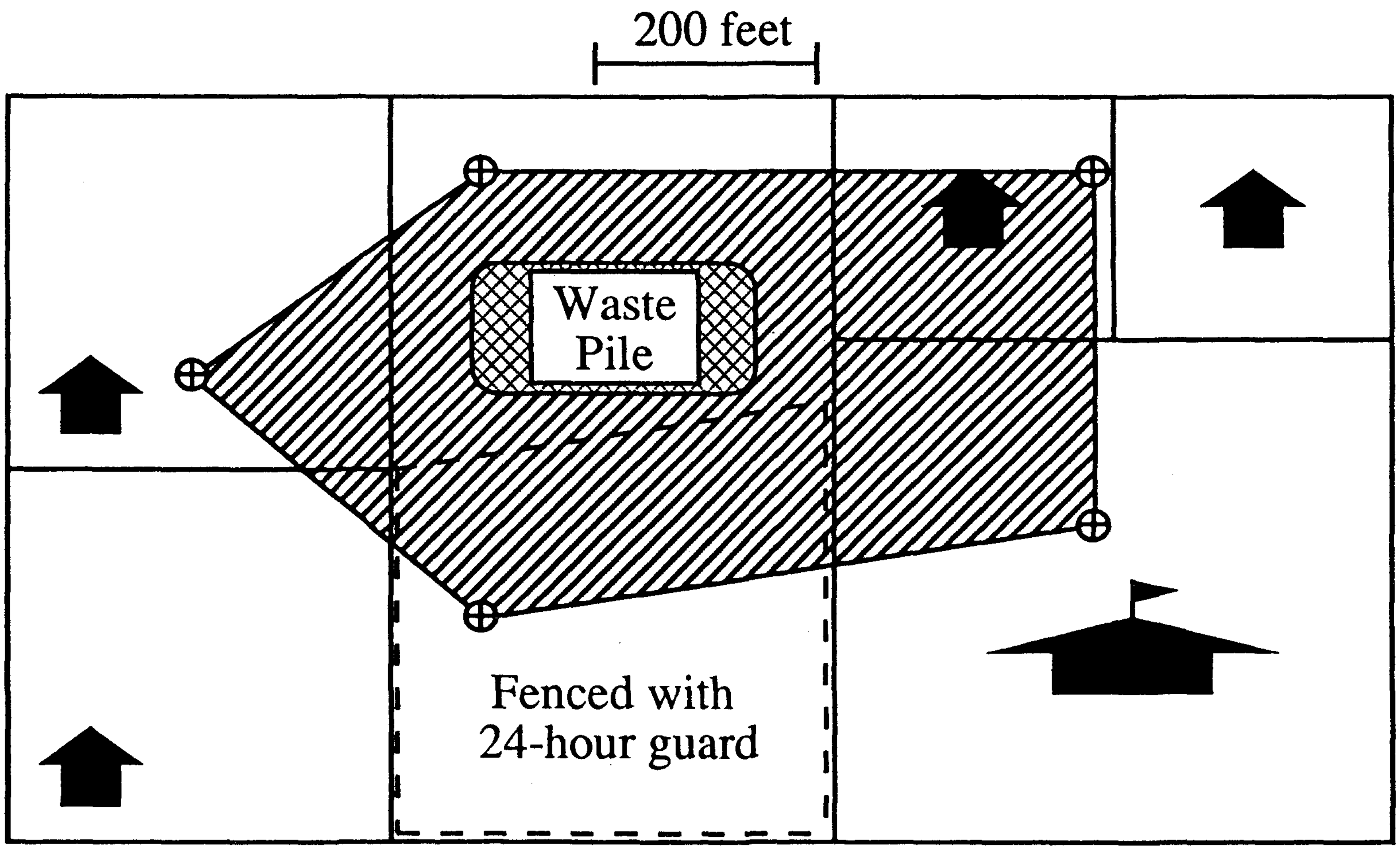
Please turn to the HRS Guidance Manual,
page 391, highlight 9-21.

- The area of contamination factor value is based on the total area of all areas of observed contamination at the site that receive an attractiveness/accessibility value greater than zero.

Waste Characteristics

- **Evaluate waste characteristics (toxicity, hazardous waste quantity) in the same manner as for the resident population threat, except:**
  - **Include only those areas of observed contamination with an attractiveness/accessibility value greater than 0.**

Waste Characteristics (Concluded)



Targets

- Evaluate nearby population threat targets based on two factors: nearby individual and population within a 1-mile travel distance from the site.

Please turn to the HRS Guidance Manual, page 389.

Please turn to the HRS Guidance Manual, page 393, highlight 9-22.

Nearby Individual

- The nearby individual is defined as the resident or student with the shortest travel distance from any area of observed contamination.
    - If one or more individuals meet the criteria for resident individual, the nearby individual factor value is zero.

Please turn to the HRS rule, page 51649, table 5-9.

Nearby Population

- Nearby population is defined as the total number of people who live or attend school within a 1-mile travel distance of an area of observed contamination and who do not meet the criteria for resident individual.

Please turn to the HRS Guidance Manual, page 385, highlight 9-18.

The Soil Exposure Pathway Concluded

Please turn to the HRS rule, table 5-1, page 51646.

SI Strategy for the Soil Exposure Pathway

- Pick up and use a plot map to identify property boundaries at the tax assessors office.

- Plan sampling locations that will document observed contamination and assess the exposure to targets.

  - On the property and within 200 feet of a residence, school, day care, or workplace.
  - Within the boundary of a terrestrial sensitive environment or a qualifying resource use.

- Read section 9.7 of the HRS Guidance Manual before evaluating the nearby population threat.

Exercise 12

Please turn to the Student Exercises, Exercise 12.

Section 20

Radionuclides

Radionuclides

- Radionuclides are unique hazardous substances that require special considerations when scoring a site.

Please turn to the HRS rule,
table 7-1, page 51663.

Radionuclide Exclusions

- CERCLA excludes a limited category of radioactive materials from the statutory definition of "release."

Please turn to the HRS Guidance Manual, page 19.

- Current EPA policy is not to list releases of radionuclides from facilities with current license issued directly by the NRC.
  - NRC is responsible for requiring and overseeing cleanup of radioactive releases at these sites.
  - EPA has authority with NRC for the cleanup of mixed and chemical waste at such sites.

Likelihood of Release

- Only the criteria for an observed release by chemical analysis are evaluated differently for radionuclides.
  - Radionuclides do not affect the potential to release or observed release by direct observation.
  - To document an observed release by direct observation, the material observed releasing must contain a radionuclide.

Please turn to the HRS rule,
section 7.1.1, page 51663.

Observed Release Criteria

- Observed release by chemical analysis criteria is different for naturally-occurring or ubiquitous radionuclides than for man-made radionuclides.

Please turn to the HRS rule,
section 7.1.1, page 51663.

Waste Characteristics

- Waste characteristics is where the most differences occur when evaluating radionuclides.

- Hazardous waste quantity:

  - Evaluate only as tier A or tier B.

  - The HRS provides conversions from volume and activities to tier A, and from volume to tier B.

- Mixed wastes:

  - Calculate source HWQ separately for radioactive and non-radioactive wastes.

  - Sum these two values to score source HWQ.

Targets

- The evaluation of targets differs in the use of benchmarks.
- For actual contamination:
  - Radionuclide benchmarks are listed in HRS section 7.3.2 and in SCDM.
  - For the soil exposure pathway, gamma radiation meeting OR criteria is considered level I.
- For mixed wastes.
  - Calculate and sum the I indices for both radioactive and non-radioactive wastes, to evaluate levels I and II.
  - The J index does not apply to radionuclides.

Exercise 13

Please turn to the Student Exercises, Exercise 13.

Student Exercises

LPQ Auto Parts

Trainer's Note

The purpose of these exercises is to learn from HRS scoring what is critical to observe, measure, sample, and record at the site inspection.

Contents

Exercise 1

Characterization of Sources

Assignment
Characterize the **buried surface impoundment, source 1**, for the HRS. This characterization entails answering 5 questions:

What type of source does the HRS consider it to be?

Where is it and what are its boundaries?

How well contained is it against release to ground water, surface water, or air?

What hazardous substances does it contain?

What quantity of hazardous substances, in HRS terms, does it contain?

Move quickly through the first four issues and spend the bulk of your time on the last, the assessment of hazardous waste quantity.

Tools
You will need the description of source 1 in the draft SI report for LPQ Auto Parts.

Source types are defined in the Hazard Ranking System (HRS) Guidance Manual beginning on page 42.

The HRS containment tables are 3-2 (page 51596) for ground water, 4-2 (page 51609) for surface water, and 6-3 (page 51652) and 6-9 (page 51653) for air.

The HRS hazardous waste quantity table is 2-5 (page 51591).

The relevant portions of the HRS Guidance Manual are section 4.1 (page 41), characterization of sources, section 7.3 (page 147), ground water containment, and chapter 6 (page 83), hazardous waste quantity.

Exercise Questions

1. What source type is this? ________________________________

   Bonus point (to be done if you have extra time): What item of critical information is lacking from the description? This item is required by one of the HRS pathways.

   ____

2. Are its location and boundaries adequately described in the draft SI report?

3. Evaluate containment against release to ground water and assign an HRS value. Document below the assertions of fact in the SI report that correspond to each dimension of HRS containment. For example, if you believe that there is "evidence of hazardous substance migration from source area" (HRS table 3-2, p. 51596, first entry), what facts from the SI report support this belief?

Before going off on a wild goose chase, look at the assigned value column for the last entry under "Surface Impoundment" in HRS table 3-2. This applies to most buried or backfilled impoundments.

____

____

____

____

The HRS value for ground water containment is: ______

Discussion: If you suspect that the potentially responsible party (PRP) might contest this factor value, what supporting evidence for the above assertions of fact would you like to be sure are in the SI report?

Bonus Points (to be done if you have extra time): If the containment factor were being evaluated for the air pathway, what information is missing from (or deficient in) the SI report?

____

____

____

____

4. What hazardous substances can be associated with this source and what is your evidence?

____

____

____

____

5. Enter below whatever data you have for each of the four tiers of hazardous waste quantity and assign a value for each tier from HRS table 2-5 (page 51591).

Tier A: Hazardous Constituent Quantity

____

____

Is tier A "adequately determined"? If so, go no further. Assign the value for hazardous waste quantity based on tier A alone.

Tier B: Hazardous Wastestream Quantity

____

____

Is tier B "adequately determined"? If so, do not evaluate volume or area. Assign the value for hazardous waste quantity based on the higher of tier A and tier B.

Tier C: Volume

____

____

Are you satisfied that your estimate of the original operating volume for the impoundment is reasonably defensible? If so, assign a value of 0 for the tier D. Otherwise, assign a 0 for tier C and go on to tier D.

Tier D: Area

____

____

Assign the hazardous waste quantity factor value for the surface impoundment: __________.

Exercise 2

Observed Release to Surface Water

Assignment
Document an observed release to the surface water (Wintergreen Run) and show how far downstream the conditions of the observed release apply. Provide documentation that this release can be properly attributed to LPQ Auto Parts.

Tools
The sample locations and analytical results are found in sections 4.3 and 4.4 of the draft SI report. The sample locations are shown on figures 2 and 11 of the SI report.

HRS section 2.3 (page 51589) lays out the criteria for an observed release and HRS section 4.1.2.1.1 (page 51609) defines observed releases to surface water.

Guidance on observed releases is found in HRS Guidance Manual, chapter 5 (page 55).

Exercise Questions

The display of analytical results in section 4.4 of the SI report has already done most of the work for you. The downstream samples are already displayed in sequence, beginning with sample 16s nearest the point where surface runoff most likely enters Wintergreen Run (the probable point of entry or PPE).

1. Circle on the display of analytical results in section 4.4 (page 27) of the SI report the substances in each sample that met the criteria for an observed release.

   Do this for both the sediment samples and the aqueous samples.

2. What information would you like to see in the SI Report to assure yourself that the sediment samples are sufficiently similar that the analytical results can legitimately be compared?

   ____

   ____

   ____

   ____

   ____

3. **Discussion:** If Leslie Percival Quickstep went into court and denied that the release was attributable to LPQ Auto Parts, what facts would you bring in to support attribution? Think rather broadly about not only the placement of the samples and the analytical results but about the operational history and the source descriptions.

____

____

____

____

____

4. **Bonus Point:** What observations, measurements, additional samples, or records could have been reasonably gathered at the SI to support the assertion of attribution of the observed release to LPQ Auto Parts?

____

____

____

____

____

____

5. Circle the sampling location on figure 11 of the SI report that represents the farthest downstream point of observed release.

> ***All surface water targets that lie between the probable point of entry (PPE) and this farthest point of observed release are considered within the zone of the observed release. The impact of this will be seen in the next presentation.***

Exercise 3

Actual Contamination of Targets

Assignment
All of the samples mentioned in this exercise show the presence of a hazardous substance. Decide whether each sample documents potential contamination, level II of actual contamination, or level I of actual contamination.

Explain the basis of your choice between potential, level II, or level I.

Tools
HRS section 2.5 (page 51592).

Figure 2 of the SI report.

The benchmarks from Superfund Chemical Data Matrix (SCDM) are summarized in reference 2 of the draft SI report.

> *Hint: When using SCDM, pay close attention to the units of measure. These will give you a clue as to what type of sample is required for comparison against the benchmark for the type of target you are assessing.*

Exercise Questions

1. In the surface water pathway, any target that lies between a sampling point and the PPE of hazardous substances into surface water is considered subject to the level of contamination found at the sampling point. What level of contamination does **ST-C** indicate wetland along Wintergreen Run for the environmental threat? Why?

   ____

   ____

   ____

2. What level of contamination does sample **8s** indicate for the wetland along Wintergreen Run? Why?

   ____

   ____

   ____

3. In the ground water pathway, level of contamination cannot be inferred from one well to another but must be documented at each well. What level of contamination is found at **MW-1**? Why?

4. What level of contamination is found at **PW-2**? Why?

5. **Bonus Points:** In the soil exposure pathway, observed release criteria and benchmarks are used to establish points of observed contamination. The pathway then specifies procedures for inferring areas of observed contamination around and between these points and for associating targets with these areas. Does sample **12s** from the drainage ditch establish a point of observed contamination? If so, is it level I or level II?

Exercise 4

Ground Water Potential to Release to the Chagrin Aquifer

Assignment
Assign a score for the ground water potential to release to the **Chagrin** aquifer.

Tools
You will need section 3 of the SI report for information about the ground water pathway and section 2.4 for the assessment of containment. You'll also need to look at various references such as the sampling data (reference 6) and the various maps and cross-sections.

HRS section 3.1.2 (page 51595).

The HRS Guidance Manual covers only the containment factor (section 7.3, page 147).

> *Use the HRS scoresheet (table 3-1), reproduced below for your convenience, for your "roadmap" to the exercise. Enter the HRS values on it as you complete the steps of the exercise on the following page.*

HRS Table 3-1, Ground Water Pathway, Likelihood of Release (page 51595)

Likelihood of Release to an Aquifer		Maximum Value	Value Assigned
1.	Observed Release	550	____
2.	Potential to Release:		
	2a. Containment	10	____
	2b. Net Precipitation	10	____
	2c. Depth to Aquifer	5	____
	2d. Travel Time	35	____
	2e. Potential to Release [lines 2a(2b+2c+2d)]	500	____
3.	Likelihood of Release (higher of lines 1 and 2e)	550	____

Exercise Questions

1. **Containment.** Assess containment for all five sources. Write down the basis for the values you assign.

   Be very wary! Is it really true that you have to assess containment for all five of the sources?

   Source 1: Buried Surface Impoundment HRS Value = 10

   Assessed under "All Sources". No firm evidence of hazardous substance migration from the source. The clay layer appears to be a liner. The cover is not "maintained and engineered" because it is made of an inappropriate material (fine sand) and has only a thin cover of vegetation. The drainage ditch shows signs of washout and erosion and provides for no management of any runoff. No leachate collection system was observed.

   Source 2: Contaminated Soil Area I HRS Value = ____

   Source 3: Buried Trench HRS Value = ____

   Source 4: Waste Pile HRS Value = ____

   Source 5: Contaminated Soil Area II HRS Value = ____

2. **Net Precipitation.** This one really is easy if you know where the site is and it doesn't lie exactly on one of the dividing lines on figure 3-2 (page 51598) of the HRS.

3. **Depth to Aquifer.** Divide this section into two questions, convert all your depth information into mean feet above sea level (MSL), and feel free to draw cross-sections. *It's awesome how much time people can spend on depth to aquifer if they don't do these things!*

   3a. How deep is it in MSL to the deepest point where you have documented the presence of hazardous substances?

   Hint: Look at the analytical data for ground water. Which wells meet observed release criteria? Look at well logs in reference 8 for these wells. Figure out the elevation (MSL) for the top of the screen. This is how deep you can be certain hazardous substances have penetrated. Now check the soil borings that show contamination significantly over background (e.g., 9d) to make sure that none of these samples can possibly be deeper than the deepest well samples. As you think in terms of MSL, remember that the deeper you go, the closer to sea level you get and the smaller the numbers are.

   3b. How deep is it in MSL to the top of the Chagrin aquifer?

4. **Travel Time.** What layers lie between the deepest point of documented contamination and the top of the Chagrin. Simply consult the geological cross section, figure 9 of the SI report.

5. **The Score.** Now that you've entered at the numbers on the scoresheet, calculate the value for likelihood of release to the Chagrin aquifer.

Exercise 5

Ground Water Pathway--Glacial Aquifer

Assignment
Score the ground water pathway for the Glacial sand and gravel aquifer.

Tools
HRS sections 2.3 (page 51589), on likelihood of release, 2.4 (particularly table 2-7, page 51591-2), on waste characteristics , and 3.0 (page 51593), on the ground water pathway.

In the HRS Guidance Manual, you may need to glance at chapter 5 (page 55), on observed releases, (particularly pages 61-63 and 69-74 which apply to the ground water pathway).

You may also need to glance at the HRS Guidance Manual, chapter 6 (page 83) on hazardous waste quantity (particularly section 6.6 on the calculation of hazardous waste quantity) and chapter 7 (page 115), on the ground water pathway.

In the SI report, you will need the ground water section, including the ground water figures, and references 2 (SCDM), 3 (USGS topo map), 6 (sample results), 7 (geological cross-section), and 8 (well logs).

Exercise Questions

1. **Observed Release to the Glacial Sand and Gravel Aquifer**

   Review the analytical data for the ground water samples. Decide which wells meet the criteria for an **observed release by chemical analysis** to the glacial sand and gravel aquifer. Summarize below the list of substances that meet the criteria for an observed release in any of the wells.

   ____

   ____

   ____

   Soil sample 9d was taken from below the water table. The substances found in this sample document an **observed release by direct observation.** The substances are chloromethane, DCE, and TCE.

2. Assignment of a Value for Toxicity/Mobility

For the limited set of substances below, select and circle the one substance that has the highest value for toxicity x mobility.

Helpful hint: If you feel you are lacking information you need to fill out the table, don't agonize. Fill in what you can and keep going. Then, come back to the sticking point and ask 'exactly what additional information is needed to make a difference in the decision about the most hazardous substances.' In other words, don't waste time on HRS issues that don't make any difference.

	Found in Observed Release by Chemical Analysis	Liquid (L) or Solid (S)	Toxicity	Mobility	Toxicity X Mobility
Chromium	_____	_____	_____	_____	_____
Lead	_____	_____	_____	_____	_____
Benzene	_____	_____	_____	_____	_____
Chloromethane	_____	_____	_____	_____	_____
Chlorophenol	_____	_____	_____	_____	_____
Dichloroethene	_____	_____	_____	_____	_____
Dichlorophenol	_____	_____	_____	_____	_____
Trichloroethylene	_____	_____	_____	_____	_____

3. Assignment of a Score for Waste Characteristics

Fill in the following portion of HRS table 3-1 (page 51595), the ground water migration pathway scoresheet:

Table 3-1, Ground Water Pathway, Waste Characteristics (page 51595)

	Factor Categories and Factors	Maximum Value	Assigned Value
4.	Toxicity/Mobility	(a)	_____
5.	Hazardous Waste Quantity	(a)	_____
6.	Waste Characteristics	100	_____

(a) Maximum value applies to waste characteristics category.

There are five sources at the site, plus a wastestream (20 tons of casting sand) that cannot be allocated to any specific source and is, therefore, treated as an unallocated source. None of these sources have a 0 value for ground water containment. The hazardous waste quantity values for the sources are:

Source		Quantity Values from Table 2-5 (p. 51591)
1	Surface impoundment	4,615.4
2	Contaminated Soil--Area I	0.3
3	Buried Trench	177.8
4	Waste Pile	5,333.3
5	Contaminated Soil--Area II	0.1
6	Unallocated Source	0.8
		10,127.7

Bonus Point 1: The sum of the quantity values for the sources is close to the HRS breakpoint of 10,000 in HRS table 2-6 (page 51591). What would happen to the score for waste characteristics if Leslie Percival Quickstep brought in information showing that the correct sum was slightly under 10,000?

Bonus Point 2: What priority actions at the SI should be taken to avoid getting booby-trapped by Leslie Percival Quickstep?

Stop here. Do not continue with the exercise until this portion has been debriefed.

4. Assignment of a Score for Targets

Fill in the following portion of HRS table 3-1, the ground water migration pathway scoresheet. In assigning the value for the aquifer, assign 550 for an observed release (line 3) and the value for waste characteristics from step 3 of this exercise (line 6).

HRS Table 3-1, Ground Water Pathway, Targets (page 51595)

	Factor Categories and Factors	Maximum Value	Assigned Value
7.	Nearest Well	50	____
8.	Population:		
	8a. Level I Concentrations	(b)	____
	8b. Level II Concentrations	(b)	____
	8c. Potential Contamination	(b)	____
	8d. Population (lines 8a+8b+8c)	(b)	____
9.	Resources	5	____
10.	Wellhead Protection Area	20	____
11.	Targets (line 7+8d+9+10)	(b)	____
	Ground Water Migration Score for an Aquifer:		
12.	Aquifer Score [(lines 3x6x11)/82,500][c]	100	____

(b) Maximum value not applicable.
(c) Do not round to nearest integer.

The easiest way to arrange the information needed to evaluate targets is to follow the format of the HRS documentation record, as shown on the following page. Arrange by distance rings (see HRS table 3-12, page 51604), beginning with the 0-1/4 mile ring, the information you have about all the drinking water wells within the target distance limit.

Once you have done this, you are ready to break out the different wells by level of contamination and by distance ring. Then, assign population to each well. When you allocate population to the Waverly wells, do not take the backup well into consideration for this part of the exercise.

Well ID	Distance From Source	Aquifer	Level I Contam. (Y/N)	Level II Contam. (Y/N)	Potential Contam. (Y/N)

Bonus Point 1: Re-evaluate the potentially exposed population, counting the Waverly backup well as though it were in regular production.

Bonus Point 2: What if the trailer park well, PW-2, had not been sampled or had been sampled and found to be uncontaminated? Recalculate the ground water pathway score. This exercise will give you a sense of the impact of the documentation of actual contamination versus potential.

Exercise 6

Surface Water Potential to Release

Assignment
Score the surface water potential to release for LPQ Auto Parts. To do this, you will have to assume that no surface water or surface water sediment samples have been taken and that no observed release to Wintergreen Run has been documented. For the purposes of this exercise only, ignore aqueous samples ST-A, ST-B, and ST-C and sediment samples 6, 16, 7, 8, 19, and 20.

Tools
In the HRS, use section 4.1.2.1.2 on pages 51609-11.

In the HRS Guidance Manual, the only relevant section is section 8.4 on surface water containment.

In the SI report, use sections 4.1 and 4.2 for information on the pathway and section 2 for the assessment of surface water containment. Use figure 2 for soil sample locations and the overland segment of the hazardous substance migration path. Use reference 3 (USGS topo map) for estimation of the size of the drainage area.

Use the portion of HRS table 4-2 that is reproduced on the next page as your roadmap through the exercise. Enter the values on this table.

Exercise Questions

1. **Containment**

   1a. Which sources will you evaluate for containment?

   ____

   ____

   ____

   1b. What is deficient about containment for all of these sources?

   ____

   ____

   ____

HRS Table 4-1, Surface Water Pathway, Likelihood of Release (page 51608)

Factor Categories and Factors			Maximum Value	Value Assigned	
Likelihood of Release:					
1.	Observed Release		550	____	
2.	Potential to Release by Overland Flow:				
	2a.	Containment	10	____	
	2b.	Runoff	25	____	
	2c.	Distance to Surface Water	25	____	
	2d.	Potential to Release by Overland Flow (lines 2a[2b + 2c])	500	____	
3.	Potential to Release by Flood				
	3a.	Containment (Flood)	10	____	
	3b.	Flood Frequency	50	____	
	3c.	Potential to Release by Flood (lines 3a x 3b)	500	____	
4.	Potential to Release (lines 2d + 3c)		500	____	
5.	Likelihood of Release (higher of lines 1 and 4)		550		____

2. Runoff

The first step in determining runoff is to identify the drainage area that will produce runoff around or through the sources and provides the vehicle for migration from the sources to surface water. Rough out this area on the portion of the USGS Topo map on the following page. HINT: Water drains perpendicular to the topographic lines. Pencil on the topo map arrows showing the direction of runoff. This will help you define the boundary of the drainage area.

2a. The approximate acreage of the drainage area is ____________ acres.

2b. The predominant soil within the drainage area is ________________.

2c. The 2-year, 24 hour rainfall is ________________ inches.

2d. The runoff factor value is ________________.

Simply process the above information through the four HRS tables 4-3 through 4-6 (page 51611) to find the value for runoff.

3. Distance to Surface Water

3a. The approximate distance to surface water is________________ feet.

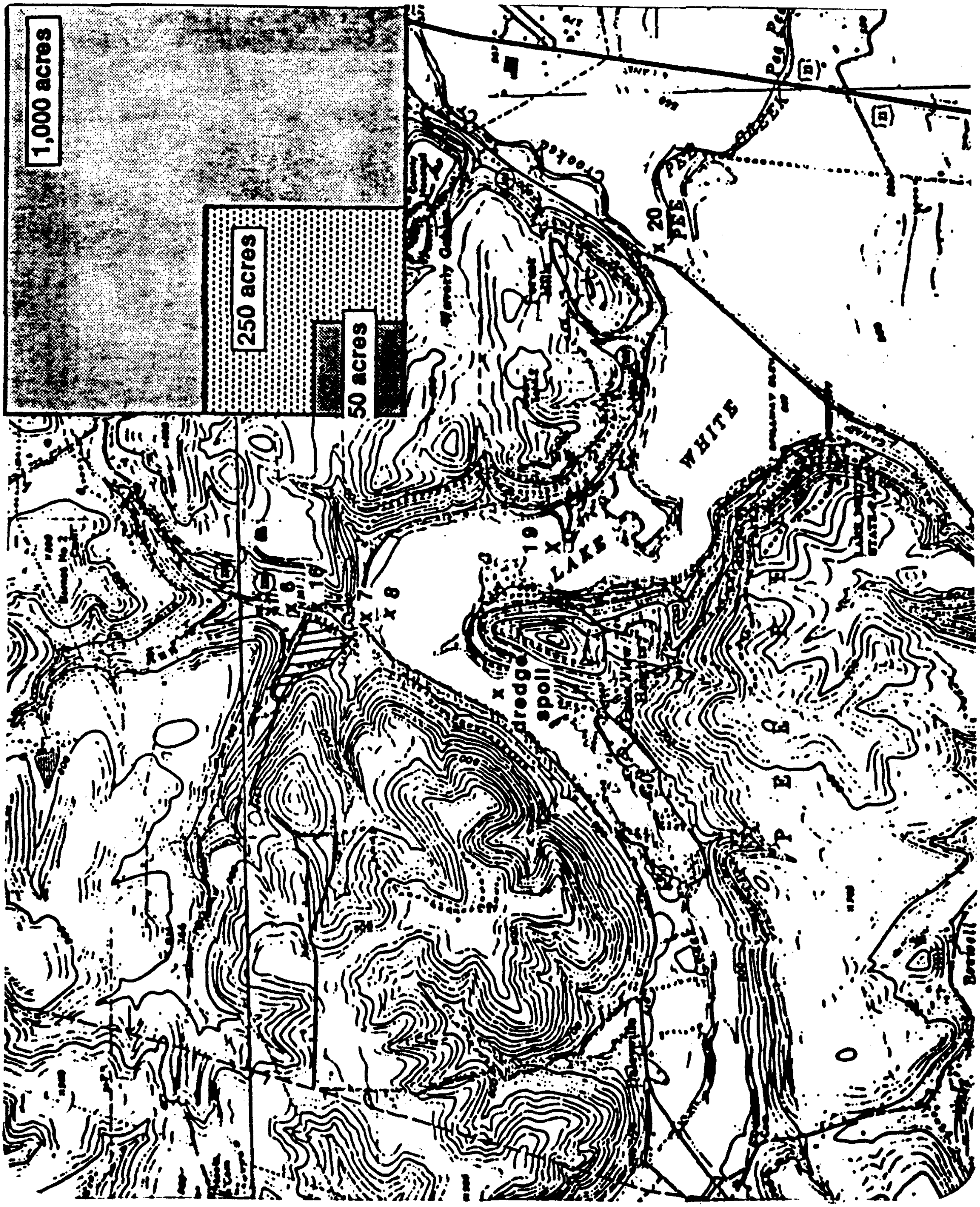
3b. What are the arguments for measuring distance to surface water from soil sample 15 versus from the extent of stained soil? If you were managing the SI and not planning to sample from Wintergreen Run, how would you seek to document distance to surface water?

4. Potential to Release by Flood

The containment of source #_______ cannot be guaranteed against a ________year flood.

5. Bonus Points

Rough out the score for the drinking water threat. What are the targets and the target score? Use lead and PCB 1254 to score waste characteristics.


1,000 acres
250 acres
50 acres
WHITE
LAKE
dredge
spoil

Exercise 7

Human Food Chain Threat

Assignment
Score the human food chain threat for LPQ Auto Parts. Use the results of exercise 2 for the assignment of an observed release to Wintergreen Run and to document the extent of surface water contamination.

Tools
HRS section 4.1.3 (page 51621).

HRS Guidance Manual sections 8-12 (page 293) and 8-13 (page 305) discuss actual contamination of the human food chain and the estimation of production.

Target information is found in section 4.2.2 of the SI report. The maps you will need are figures 2 and 10 in the SI report and reference 3, the USGS topo map.

Use the portion of HRS table 4-1 that is reproduced on the next page as your roadmap through the exercise. Enter the values on this table.

Exercise Questions

1. **Waste Characteristics**

Restrict the evaluation of toxicity/persistence/bioaccumulation to the following items:

Substance	Toxicity	Persistence	Bioaccum. (BCFV)	Tox. x Pers. x BCFV
Chromium III	______	______	______	______
Chromium VI	______	______	______	______
Dichloroethene	______	______	______	______
PCB 1254	______	______	______	______
Trichloroethylene	______	______	______	______

The most hazardous substance for the threat is: ____________________.

HRS Table 4-1, Surface Water Pathway, Human Food Chain Threat (page 51608)

Factor Categories and Factors	Maximum Value	Value Assigned	
Likelihood of Release:			
14. Likelihood of Release (same value as line 5)	550		____
Waste Characteristics:			
15. *Toxicity/Persistence/Bioaccumulation*	*(a)*	____	
16. Hazardous Waste Quantity	(a)	____	
17. Waste Characteristics	1,000		____
Targets:			
18. Food Chain Individual	50	____	
19. Population			
19a. Level I Concentrations	(b)	____	
19b. Level II Concentrations	(b)	____	
19c. Potential Human Food Chain Contamination	(b)	____	
19d. Population (lines 19a + 19b + 19c)	(b)	____	
20. Targets (lines 18 + 19d)	(b)		____
Human Food Chain Threat Score:			
21. Human Food Chain Threat Score ([lines 14 x 17 x 20]/82,500)	100		____

(a) Maximum value applies to waste characteristics category.
(b) Maximum value not applicable.

The values for hazardous waste quantities for the sources are found in step 3 of exercise 5. Do any of these sources have a "0" value for surface water containment (see step 1 of exercise 6)?

What is the sum of source quantities for the surface water pathway?

____

Assign a value for hazardous waste quantity from HRS table 2-6 (page 51591) and enter it on the scoresheet.

Assign a score for waste characteristics using the instructions in HRS section 4.1.3.2.3 and enter it on the scoresheet.

2. Segmentation of the In-Water Portion of the Hazardous Substance Migration Path into Fisheries.

What portions of the in-water segment of the hazardous substance migration path are subject to level I concentrations? To level II concentrations? To potential contamination? In answering these questions, you may want to review the analytical results in section 4.4 of the SI report. Do not ignore the fish tissue sample. You may also want to look at your conclusions in exercise 2.

Read and apply the second bullet at the top left of HRS page 51621. If the level of contamination changes within a fishery, you will have to divide that fishery into two fisheries.

Enter here the fisheries that will be assessed and the level of contamination in each:

Fishery	Level of Contamination

Bonus Point:

Calculate the average annual flow of Wintergreen Run from the information given in section 4.1 of the SI report.

3. Targets

3a. Assign a value for **food chain individual** and enter it into the HRS scoresheet.

Before plunging into calculating food chain production and food chain population for each fishery, calculate the human food chain threat score based on the target value of the food chain individual.

3b. Assign a value for the human food chain production of Wintergreen Run.

The information you need is: (1) Wintergreen Run from the PPE to Lake White is about 1320 feet long, judged from reference 2 of the SI report, (2) the SI report says Wintergreen Run is 5 foot wide, (3) there are 43,560 square feet to the acre, (4) the production per acre is unknown but should be around the 5 lbs/acre that is characteristic of Pee Pee Creek, unless a lot of salmon wander up the creek and are caught. In that case, the production might approach the 45 lbs/acre that is characteristic of Lake White. Does this range of uncertainty make any difference in the value assigned?

3c. Complete the worksheet that is provided below. Assume that sample 19 defines 1/3 of the surface area of Lake White as a level I or II fishery and 2/3 of Lake White as a potential fishery.

Fishery	Production Estimate in Pounds	Pop. Value	Level of Contam.	Dilution Weighted Population
Wintergreen Run	____	____	____	na
Lake White--Level I	____	____	____	na
Lake White--Level II	____	____	____	na
Lake White--Potential	____	____	____	____
Pee Pee Creek	____	____	____	____
Scioto River	____	____	____	____

Enter onto the scoresheet the population values for the level I, level II, and potential fisheries and complete the score for the human food chain threat.

Bonus Points: Should the estimate that 2/3 of the surface area of Lake White is a potential fishery be refined? Should Wintergreen Run be considered to be a fishery?

Exercise 8

Surface Water Environmental Threat

Assignment
Score the environmental threat for LPQ Auto Parts.

Tools
In the SI report, use Section 4.2.3 on environmental targets, as well as the maps showing surface water sampling locations, and the analytical results for surface water samples.

HRS section 4.1.4 (page 51621), on the environmental threat.

HRS Guidance Manual sections 8-13 (page 305), 8-14 (page 317), and 8-15 (page 325), and Appendix A (page A-1).

Exercise Questions

1. **Waste Characteristics**

   The values in SCDM for PCB 1254 for the environmental threat are all maximum. Use the HRS scoresheet on the following page to assign a score for waste characteristics for the environmental threat based on PCB 1254.

   The Bonus Points in step 6 will give you an opportunity to look at waste characteristics in more depth.

2. **Segmentation of the Surface Water into Zones of Contamination**

   In section 4.4 of the SI report, review the analytical results to decide which sampling points, if any, document level I or level II concentrations for the environmental threat.

   16s ______________

   7s ______________

   8s ______________

   19s ______________

   ST-B ______________

   Based on these sample locations, decide which surface water bodies, or portions of surface water bodies are at level I concentrations, at level II concentrations, and at potential contamination.

3. Identification of Targets along the In-Water Segment

In section 4.2.3 of the SI report, circle or underline each sensitive environment that is assigned a value by HRS table 4-23 (page 51624) and write the assigned value in the margin.

Note also the existence of wetland frontage along the various water bodies within the target distance limit. For the wetland frontage along Lake White, assume that 1,050 feet of wetland frontage lie within the zone of level II concentrations and 4,000 feet of frontage within the zone of potential contamination.

Compile the information you have gathered on the following table. This format, or one like it, will make step 4 of this exercise relatively easy.

Level of Contam.	Water Body	Wetland Frontage	Sensitive Environments
Level II	Wintergreen Run	______	______________________
Level II	Lake White	______	______________________
Potential 10-100 cfs	Lake White	______	______________________
Potential 10-100 cfs	Pee Pee Creek	______	______________________
Potential ~5,000 cfs	Scioto River	______	______________________

If you think you have any targets at level I concentrations, go back to step 2 of this exercise. Did you note that environmental benchmarks are stated in $\mu g/l$? This means that aqueous samples are required to document the level of contamination against environmental benchmarks.

Sample 19s defines the farthest downstream point of observed release. This sediment sample defines the breakpoint between level II and potential contamination.

4. Evaluation of Targets

Look carefully at the formulas for level II and potential contamination on HRS page 51625. Note also the rounding rule that follows the formula for potential contamination. These are the formulas and rule you will be applying in assigning target values to sensitive environments and wetlands.

HRS Table 4-1, Surface Water Pathway, Environmental Threat (page 51608)

Factor Categories and Factors	Maximum Value	Value Assigned	
Likelihood of Release:			
22. Likelihood of Release (same value as line 5)	550		550
Waste Characteristics:			
23. Ecosystem Toxicity/Persistence/Bioaccumulation	(a)	_____	
24. Hazardous Waste Quantity	(a)	_____	
25. Waste Characteristics	1,000		_____
Targets:			
26. Sensitive Environments			
26a. Level I Concentrations	(b)	_____	
26b. Level II Concentrations	(b)	_____	
26c. Potential Contamination	(b)	_____	
26d. Sensitive Environments (lines 26a + 26b + 26c)	(b)	_____	
27. Targets (value from line 26d)	(b)		_____
Environmental Threat Score:			
28. Environmental Threat Score ([lines 22 x 25 x 27]/82,500)	60		_____
Surface Water Overland/Flood Migration Component Score for a Watershed			
29. Watershed Score (lines 13 + 21 + 28)	100		_____

(a) Maximum value applies to waste characteristics category.
(b) Maximum value not applicable.
(c) Do not round to nearest integer.

8: Surface Water Environmental Threat

Assign target values for the sensitive environment threat and enter them on the scoresheet.

5. Complete the Surface Water Pathway

5a. Assign a score for the environmental threat.

5b. Assign a score for the surface water pathway.

6. Bonus Point

What would be the impact on the environmental threat score if PCB 1254 had not been found at the site? Approach this question by identifying first which HRS factor will be affected, and then assess the impact on score.

Exercise 9

Air Potential to Release

Assignment
Assign a value for the air potential to release.

Tools
HRS section 6.1 (page 51651).

HRS Guidance Manual section 10.2 (page 403).

In the SI report, the description of source 4 and the analytical results for the samples taken at source 4.

Exercise Questions

1. **Identify the Substances Associated With the Waste Pile**

   For the purpose of this exercise, evaluate only the waste pile. The values for the other sources have been calculated for you.

   The first step is to identify whether the source is to be evaluated for gas potential to release, particulate potential to release, or both. This depends on the characteristics of the substances present in the source.

   List below all of the substances present in the waste pile and note whether each substance is a gaseous substance, a particulate substance, or both. To save time, while you are using SCDM, write in the gas migration potential value for each gaseous substance in the source.

Substance	Gaseous? Y/N	Particulate? Y/N	Gas Migration Pot'l Value

____

____

____

____

____

____

2. Evaluate the Gas Potential to Release

Enter on HRS table 6-2, reproduced here for your convenience, the values for gas potential to release and select the value for the highest-scoring source.

HRS Table 6-2, Gas Potential to Release Evaluation (page 51651)

Source	Source Type	Gas Containment Factor Value	Gas Source Type Factor Value	Gas Migration Potential Factor Value	Sum	Gas Source Value
		A	B	C	(B+C)	Ax(B+C)
1.	Buried Surface Impound.	10	11	17	28	280
3.	Other Waste Pile (Trench)	0	17	11	28	0
4.	____	____	____	____	____	____
5.	Contaminated Soil	10	0	11	11	110

Gas Potential to Release Factor Value ____________
(select the highest gas source value)

Bonus Point: Why was source 5 assigned a 0 for gas source type?

3. Evaluate the Particulate Potential to Release

Enter on HRS table 6-8, reproduced here for your convenience, the values for particulate potential to release, complete the table, and select the value for the highest-scoring source.

HRS Table 6-8, Particulate Potential to Release Evaluation (page 51653)

Source	Source Type	Particulate Containment Factor Value	Partic. Source Type Factor Value	Particulate Migration Potential Factor Value	Sum	Particulate Source Value
		A	B	C	(B+C)	Ax(B+C)
1.	Buried Surface Impound.	10	22	____	____	____
2	Contaminated Soil	10	0	____	____	____
3.	Other Waste Pile (Trench)	0	28	____	____	____
4.	________	____	____	____	____	____
5.	Contaminated Soil	10	0	____	____	____

Particulate Potential to Release Factor Value ____________
(select highest particulate source value)

4. Assign the Score for Likelihood of Release

Enter the values for gas potential to release and particulate potential to release on the HRS scoresheet for the air pathway and determine the value for likelihood of release for LPQ Auto Parts.

5. Bonus Point

Why were zeros assigned for gas and particulate containment for the buried trench? What is the implication of these zeros for waste characteristics?

HRS Table 6-1, Air Pathway, Likelihood of Release (page 51651)

Factor Categories and Factors		Maximum Value	Value Assigned	
Likelihood of Release:				
1.	Observed Release	550	____	
2.	Potential to Release			
	2a. Gas Potential to Release	500	____	
	2b. Particulate Potential to Release	500	____	
	2c. Potential to Release (higher of lines 2a and 2b)	500	____	
3.	Likelihood of Release (higher of lines 1 and 2c)	550		____

Exercise 10

Air Targets

Assignment
Evaluate target for the air pathway at LPQ Auto Parts and assign a score for the air pathway.

Tools
HRS section 6.3 (page 51660).

In the HRS Guidance Manual, use pages 416-7 and 420 for information on the nearest individual.

In the SI report, use the maps and section 5 on the air pathway. Refer to exercise 8 for the location and values of the various sensitive environments.

Exercise Questions

1. **Evaluate Human Targets**

   Assign HRS values for nearest individual and for population subject to potential contamination and enter the values in the HRS scoresheet.

Distance Ring	Number of Residences	Total Population	Distance-Weighted Population Value
On a Source	______	______	______
>0 - 1/4	______	______	______
>1/4 - 1/2	______	______	______
>1/2 - 1	______	______	______
>1 - 2	______	______	______
>2 - 3	______	______	______
>3 - 4	______	______	______

Sum of Distance-Weighted Population: ______

2. Evaluate Resources and Environmental Targets

What resources for the air pathway lie within the air pathway distance limit for resources? Enter a value for resources on the HRS scoresheet.

Assess the wetlands and sensitive environments that lie within the distance rings. Follow the formula for potential contamination on HRS page 51662 carefully. The table below is for your convenience. It is not an HRS table but is similar to what is used in an HRS documentation record.

Distance Ring	Wetland Acreage	HRS Value for Wetlands	HRS Value for Sens. Environments	Distance Weights	Distance Weighted Value
On a Source	______	______	______	______	______
>0 - 1/4	______	______	______	______	______
>1/4 - 1/2	______	______	______	______	______
>1/2 - 1	______	______	______	______	______
>1 - 2	11.36	______	______	______	______
>2 - 3	______	______	______	______	______
>3 - 4	59.38	______	______	______	______

Sum of Distance-Weighted Environments: ______

3. Complete the Air Pathway

On the scoresheet for the air pathway, enter the score for likelihood of release from the previous exercise.

The score for waste characteristics is 32. This is based on an air toxicity/mobility value for PCB 1254 or vinyl chloride of 10,000 and a hazardous waste quantity value of 100. The value for hazardous waste quantity is 100 rather than the 10,000 that was used for the ground water and surface water pathways because the buried trench has gas and particulate containment values of 0 and is not, therefore, evaluated for the air pathway.

Complete the air pathway scoresheet.

HRS Table 6-1, Air Migration Pathway Scoresheet (page 51651)

Factor Categories and Factors			Maximum Value	Value Assigned	
Likelihood of Release:					
3.	Likelihood of Release (from exercise 9)		550		____
Waste Characteristics:					
6.	Waste Characteristics (assigned in exercise)		100		32
Targets:					
7.	Nearest Individual		50	____	
8.	Population				
	8a.	Level I Concentrations	(b)	____	
	8b.	Level II Concentrations	(b)	____	
	8c.	Potential Contamination	(b)	____	
	8d.	Population (lines 8a+8b+8c)	(b)	____	
9.	Resources		5	____	
10.	Sensitive Environments				
	10a.	Actual Contamination	(c)	____	
	10b.	Potential Contamination	(c)	____	
	10d.	Sensitive Environments (lines 10a+10b)	(c)	____	
11.	Targets (lines 7+8d+9+10c)		(b)		____
Air Migration Pathway Score					
12.	Pathway Score [(lines 3x6x11)/82,500]		100		____

(a) Maximum value applies to waste characteristics category.
(b) Maximum value not applicable.
(c) No specific maximum value applies to factor. However, pathway score based solely on sensitive environments is limited to a maximum of 60.
(d) Do not round to nearest integer.

4. Bonus Points

Assume that air sampling was done at the SI with the release sample taken 50 feet east of contaminated soil area II (source 5). The results show vinyl chloride significantly over background and also over the cancer risk benchmark of 0.012 $\mu g/m^3$.

Rough out a score for the air pathway.

Exercise 11

Soil Exposure--Resident Population Threat

Assignment
Evaluate the resident population threat of the soil exposure pathway

Tools
HRS sections 5.0 and 5.1 (pages 51644-48).

HRS Guidance Manual sections 9.1 through 9.6 (pages 343-375).

In the SI report, use section 6 on the soil exposure pathway, the map of soil/sediment sampling locations (figure 2), and the analytical results (reference 6).

Exercise Questions

1. **Define Areas of Observed Contamination**

   Define the points of observed contamination, based on the analytical results reported in section 6 of the SI report. Indicate the points of observed contamination on figures 2 and 10 of the Si report.

   Define the areas of observed contamination accurately enough to be able to decide which targets are to be counted as resident targets.

2. **Evaluate Waste Characteristics**

   The hazardous waste quantity values for three of the areas of observed contamination are given below. Complete the assignment of a value for hazardous waste quantity for the soil exposure pathway and enter the value in the HRS scoresheet.

1. Surface Impoundment	4,615.4
2. Contaminated Soil Area I	0.3
3. Buried Trench	_____
4. Waste Pile	_____
5. Contaminated Soil Area II	0.1
6. Other areas of Observed Contamination	_____
Total for areas of observed contamination:	______

11: Soil Exposure Resident Population Threat

Define the set of substances that can be assessed for toxicity. Select the highest-scoring substance and enter its value in the HRS scoresheet.

Assign a score for waste characteristics from HRS table 2-7 (page 51592).

Bonus Point: The value for hazardous waste quantity for the soil exposure pathway is frequently smaller than it is for the migration pathways. Why?

3. Evaluate Targets Associated with the Areas of Observed Contamination

Which targets are considered to be resident targets? Review the first four bullets in HRS section 5.1 (page 51646) carefully and complete the scoresheet for the resident population threat.

HRS Table 5-1, Soil Exposure, Resident Population Threat (page 51646)

	Factor Categories and Factors	Maximum Value	Value Assigned	
Likelihood of Exposure:				
1.	Likelihood of Exposure	550		____
Waste Characteristics:				
2.	Toxicity	(a)	____	
3.	Hazardous Waste Quantity	(a)	____	
4.	Waste Characteristics	100		____
Targets:				
5.	Resident Individual	50	____	
6.	Resident Population			
	6a. Level I Concentrations	(b)	____	
	6b. Level II Concentrations	(b)	____	
	6c. Population (lines 6a + 6b)	(b)	____	
7.	Workers	15	____	
8.	Resources	5	____	
9.	Terrestrial Sensitive Environments	(c)	____	
11.	Targets (lines 5 + 6c + 7 + 8 + 9)	(b)		____
Resident Population Threat:				
12.	Resident Population Threat (lines 1x4x10)	(b)		____

(a) Maximum value applies to waste characteristics category.
(b) Maximum value not applicable.
(c) No specific maximum value applies to factor. However, pathway score based solely on sensitive environments is limited to a maximum of 60.

11: *Soil Exposure Resident Population Threat*

Exercise 12

Soil Exposure--Nearby Population Threat

Assignment
Evaluate the nearby population threat of the soil exposure pathway for LPQ Auto Parts.

Tools
HRS section 5.2 (page 51648).

HRS Guidance Manual sections 9.7 (page 383) and 9.8 (page 389) on the nearby population threat.

In the SI report, use the description of areas of observed contamination from exercise 11 and the USGS topo map (reference 3).

Exercise Questions

1. **Assess the Likelihood of Exposure to the Areas of Observed Contamination**

1a. The highest value for attractiveness/accessibility for any of the areas of observed contamination within the fence line of LPQ Auto Parts is: ________

1b. The value for attractiveness/accessibility for the area of observed contamination along the intermittent stream is: ________

1c. The value for attractiveness/accessibility for the area of observed contamination defined by samples A, C, D, and E is: ________

1d. The highest value for attractiveness/accessibility is: ________. Enter this value on the scoresheet.

1e. Assign values for area of contamination and likelihood of exposure for the nearby population threat. Enter these values in the HRS scoresheet.

The areas of observed contamination are:

	Square Feet
Surface Impoundment	60,000
Waste Pile	45,000
Soil around samples 12, 14, and 15	9,600
Soil around sample 17	2,400
Soil between 17 and 15	5,600
Soil between samples A, C, D, and E	3,400

Bonus Point: What characteristics must an area of observed contamination have to receive a score of 500 for likelihood of exposure for the nearby population threat?

2. Assess Waste Characteristics for the Areas of Observed Contamination

2a. Assign a value for **toxicity** and enter it in the HRS scoresheet. For the resident population threat, the maximum value of 10,000 for toxicity was assigned, based on chlordane, chromium (NOS or VI), lead, PCB 1254, or vinyl chloride. Drop from consideration any substances found only on private property or areas with an attractiveness/accessibility value of 0.

2b. Assign a value for **hazardous waste quantity** from HRS table 2-6 (page 51591) and enter this value in the HRS scoresheet. For hazardous waste quantity, start off with the value for the total areas of contamination for the resident population threat (5,939.7) and subtract the value for any areas of observed contamination on residential property or with an attractiveness/accessibility value of 0.

2c. Assign a value for waste characteristics for the nearby population threat.

3. Assess Targets Within 1 Mile Travel Distance

3a. Assign a value for nearby individual and enter it in the HRS scoresheet.

3b. Estimate the population within each of the travel distance categories.

Travel Distance	Population
>0 to 1/4 mile	______
>1/4 to 1/2 mile	______
>1/2 to 1 mile	______

3c. Based on this estimate, assign a value for population within 1 mile and enter it in the HRS scoresheet. Also enter the score for targets.

4. Complete the Score for the Soil Exposure Pathway

Finish the calculation of the score for the soil exposure pathway.

HRS Table 5-1, Soil Exposure, Nearby Population Threat (page 51646)

Factor Categories and Factors		Maximum Value	Value Assigned	
Likelihood of Exposure				
12.	Attractiveness/Accessibility	100	____	
13.	Area of Contamination	100	____	
14.	Likelihood of Exposure	500		____
Waste Characteristics				
15.	Toxicity	(a)	____	
16.	Hazardous Waste Quantity	(a)	____	
17.	Waste Characteristics	100		____
Targets				
18.	Nearby Individual	1	____	
19.	Population Within 1 Mile	(b)	____	
20.	Targets (lines 18 + 19)	(b)		____
Nearby Population Threat Score				
21.	Nearby Population Threat Score (lines 14x17x20)	(b)		____
Soil Exposure Pathway Score				
22.	Soil Exposure Pathway Score[d] (lines [11 + 21]/82,500)	100		____

(a) Maximum value applies to waste characteristics category.
(b) Maximum value not applicable.
(d) Do not round to nearest integer.

12: Soil Exposure Nearby Population Threat

Exercise 13

Calculation of Site Score for LPQ Auto Parts

Assignment

Calculate the site score for LPQ Auto Parts.

HRS Pathway	Pathway Score	Pathway Score Squared
Ground Water	100.00	_______
Surface Water	100.00	_______
Soil Exposure	23.68	_______
Air	4.09	_______
	Sum of squares:	_______
	Divided by 4:	_______

Site Score _______

Site Inspection Narrative Report

LPQ Auto Parts

Trainer's Note

The information on LPQ Auto Parts is fictional. The site does not exist. The environmental setting, however, is based on actual information wherever possible.

Caution: This draft SI report does **not** provide a model for your SI reports. It has been adapted for the purposes of the exercises in this training.

Contents

Figures

References

1. U.S. Environmental Protection Agency. Hazard Ranking System, 55 FR 51583, December 14, 1990 (40 CFR part 300, Appendix A).

2. Superfund Chemical Data Matrix, U.S. Environmental Protection Agency, March 6, 1993 [relevant pages included].

3. U.S. Geological Survey, 7.5-minute topographic quadrangle maps of Ohio: Piketon, 1960 [on each table].

4. U.S. Department of Commerce. 1983. "The Climatic Atlas of the United States."

5. U.S. Department of Commerce. 1961. "Technical Paper No. 40."

6. Summary of Sampling Results [included].

7. Geological Cross-section [on each table].

8. Graphic of Well Logs [on each table].

Date: January 1994

Prepared by: ABC Environmental Consulting Group
Portsmouth, Ohio

Site: LPQ Auto Parts
County Route 220
Pike County, Ohio

EPA ID No.: XXY987654321

1. Introduction

Under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), the U.S. Environmental Protection Agency (EPA), Waste Management Division, Region 5 conducted a site inspection (SI) at LPQ Auto Parts near Waverly in Pike County, Ohio. The purpose of this investigation was (1) to collect information concerning conditions at LPQ Auto Parts sufficient to assess the threat posed to human health and the environment (2) to determine the need for additional investigation under CERCLA or other authority and (3), if appropriate, support site evaluation using the Hazard Ranking System (HRS) for proposal to the National Priorities List (NPL). The investigators reviewed previous information, sampled waste and environmental media to test preliminary assessment (PA) hypotheses and to evaluate and document HRS factors, and collected additional non-sampling information (including interviewing nearby residents).

2. Site Description

2.1 Location

LPQ Auto Parts is located on County Route 220 just north and west of the intersection with County Route 228 at Lake White and 1.6 miles west of the city limits of Waverly in Pike County, Ohio. The geographic coordinates are lat. 39°07'53" N, long. 83°01'53" W (Reference 3). Figure 1 is a copy of the topographic map in the vicinity of the site. Figure 2 is a site map.

Pike County is characterized by cool temperate climate. Summers are warm and humid with daily temperature reaching 80°F or higher. Daily high temperatures during winter are 25°F to 35°F. Net annual precipitation for the area is 40.5 inches (Reference 4) and the 2-year, 24-hour rainfall is 2.7 inches (Reference 5).

Figure 1: Topographic Map

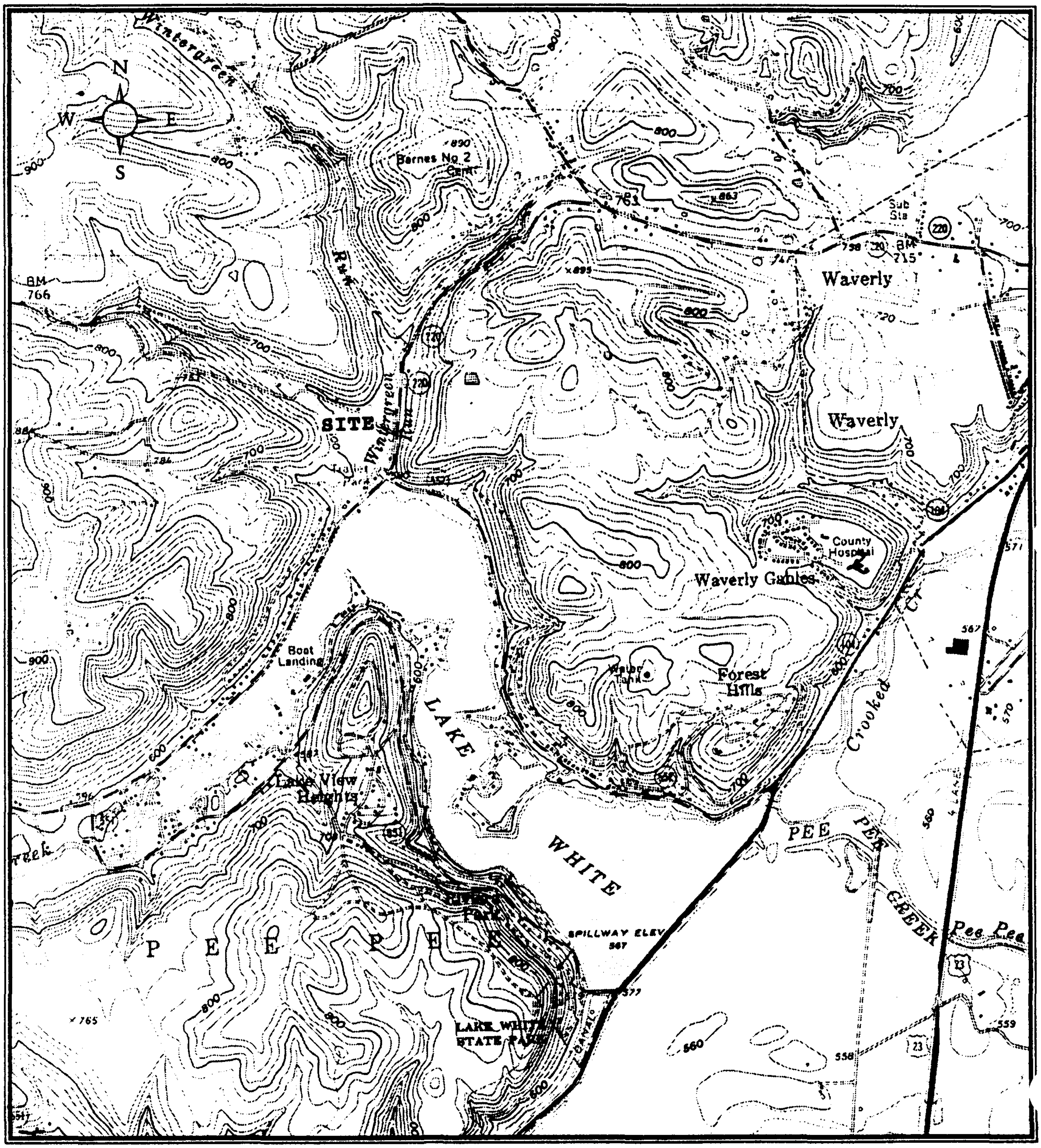
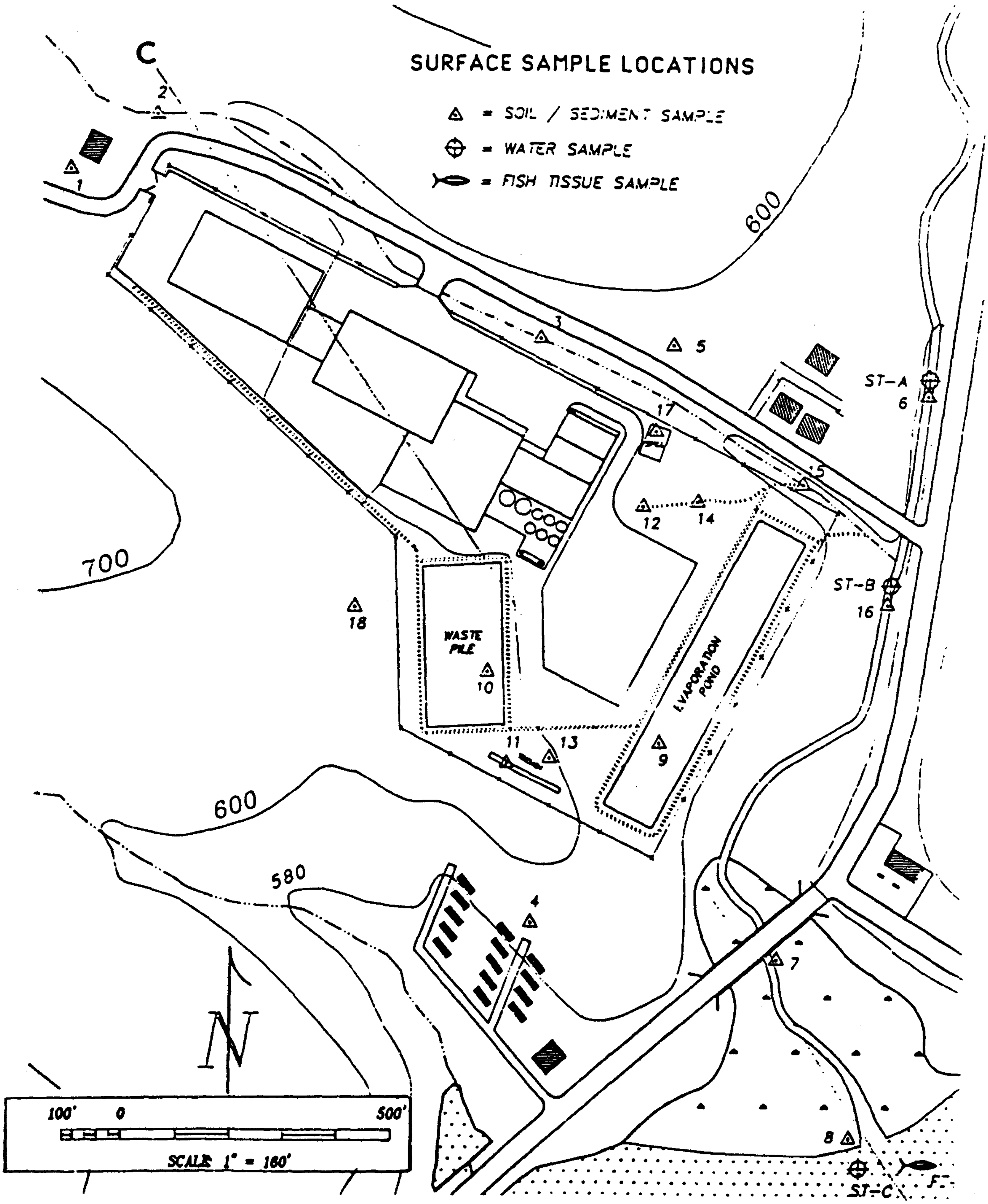


Figure 2: Site Map (Soil and Sediment Locations)



2.2 Site Description

The LPQ property covers 14 acres of relatively flat terrain. The site slopes from slightly over 600 feet MSL in the west to about 580 feet along its eastern border with Wintergreen Run, a minimal perennial stream. An unnamed intermittent tributary of Wintergreen Run borders the northern side of the site. Hills rise sharply to the west and north. A wetland associated with Lake White lies close to the southeastern corner of the property (Figures 1 and 2).

The onsite facilities include a small, metal casting foundry, a milling shop, a plastics casting shop, an electroplating shop, a soldering and welding shop, a paint shop, and an engine rebuilding and maintenance facility for its fleet of trucks. The foundry has been closed since 1978.

There are five identified sources at the site: a large surface impoundment (now backfilled), a waste pile, a buried trench, and two areas of contaminated soil. Drainage ditches run around the waste pile and impoundment and through one of the areas of contaminated soil. The ditches empty into the intermittent stream.

Most of the property boundary is fenced except for part of the back of the property which is heavily wooded and abuts against the hill. Although the main gate is left open, there is no evidence of trespassing on the waste sources themselves. The maintenance workers have indicated the parking lot on the eastern side of the site is used by local teenagers on Friday and Saturday evenings, and that they have collected numerous beer cans in that area.

2.3 Operational History

The company was founded in 1919 for the manufacture of racing car parts for the owner, Louanne Penelope Quickstep (LPQ) and expanded as a parts manufacturer with the American automobile industry. The foundry was abandoned in 1978 when new air pollution regulations were enforced. In the past 20 years, the company has increasingly relied on plastic casted parts, phasing out the metal casted parts. In the 1970s, the company consolidated all of its operations at this Ohio facility.

The company is currently in Chapter 11 bankruptcy reorganization. There are currently a minimum of four individuals at the facility during the day: two general maintenance workers who maintain the physical plant and who do the yard work, the former general manager/owner of the company, and his secretary clerk.

The company never completed a RCRA permit application and the owner has stated that he has no intent or money to fund any remedial actions.

2.4 Description and Sampling of the Sources

2.4.1 The Surface Impoundment (Source 1)

A RCRA permit application that was apparently never filed indicates that the impoundment was designed as a shallow evaporation basin of 100 feet by 600 feet (see Figure 3). The impoundment has been backfilled, but a quick visual inspection indicates that the cover material seems to be sand similar to that used for casts. The depth of sand at the edges of the area was less than 2 feet based on four borings made with a soil auger, and seems to be underlined by a compacted clay layer or, perhaps, by fine sediments. A boring to 11 feet deep was taken through the middle of the impoundment. Here, the compacted layer was encountered at just over 3 feet.

The sand has a thin cover of vegetation. A drainage ditch runs around the south and west sides of the impoundment, carrying rainwater to the intermittent stream and then to Wintergreen Run. A drainage ditch on the east side shows signs of washouts and erosion. No leachate collection system was observed during the site inspection.

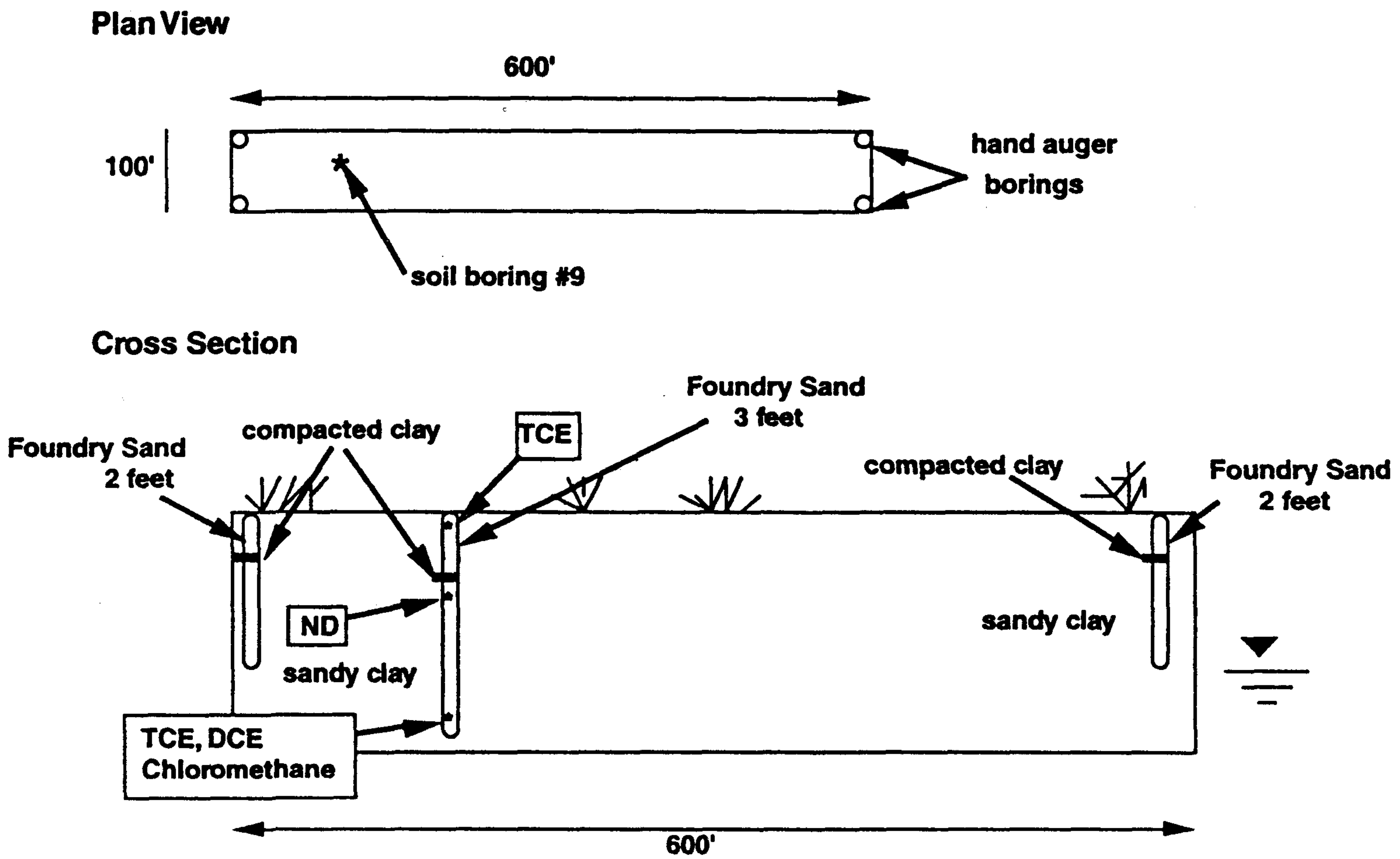
The impoundment received wastewater from the engine rebuilding and truck maintenance shops. This area used "Disolv-O-Grease" which, according to company records, was purchased at a rate of 10 gallons a week for 50 weeks a year from 1980 through 1988 (no records prior to 1980 exist). According to the company president, the degreaser product was used as a spray to clean used engine parts prior to their rebuilding and in the truck maintenance area during truck cleaning and repair. The spray was followed by a water rinse. He also stated that the total volume of wastewater from these processes was estimated to be about 200 gallons a week, based on an engineering study in 1988. He stated that any liquid wastes from the milling, plastics molding, painting, or electroplating shops were centrally collected rather than discharged to the impoundment. These wastes were held for reuse or sold to a recycler when one could be found.

The impoundment was closed in 1988 and all waste flows were routed into the Lake White sanitary sewer system.

The producer of "Disolv-O-Grease" was contacted and indicated the product was mainly stoddard solvents with detergents, but contained trichloroethylene (TCE) from 1980 to 1986. After 1986, the TCE was replaced in the formulation to avoid having to meet RCRA and OSHA requirements for handling the chlorinated solvent.

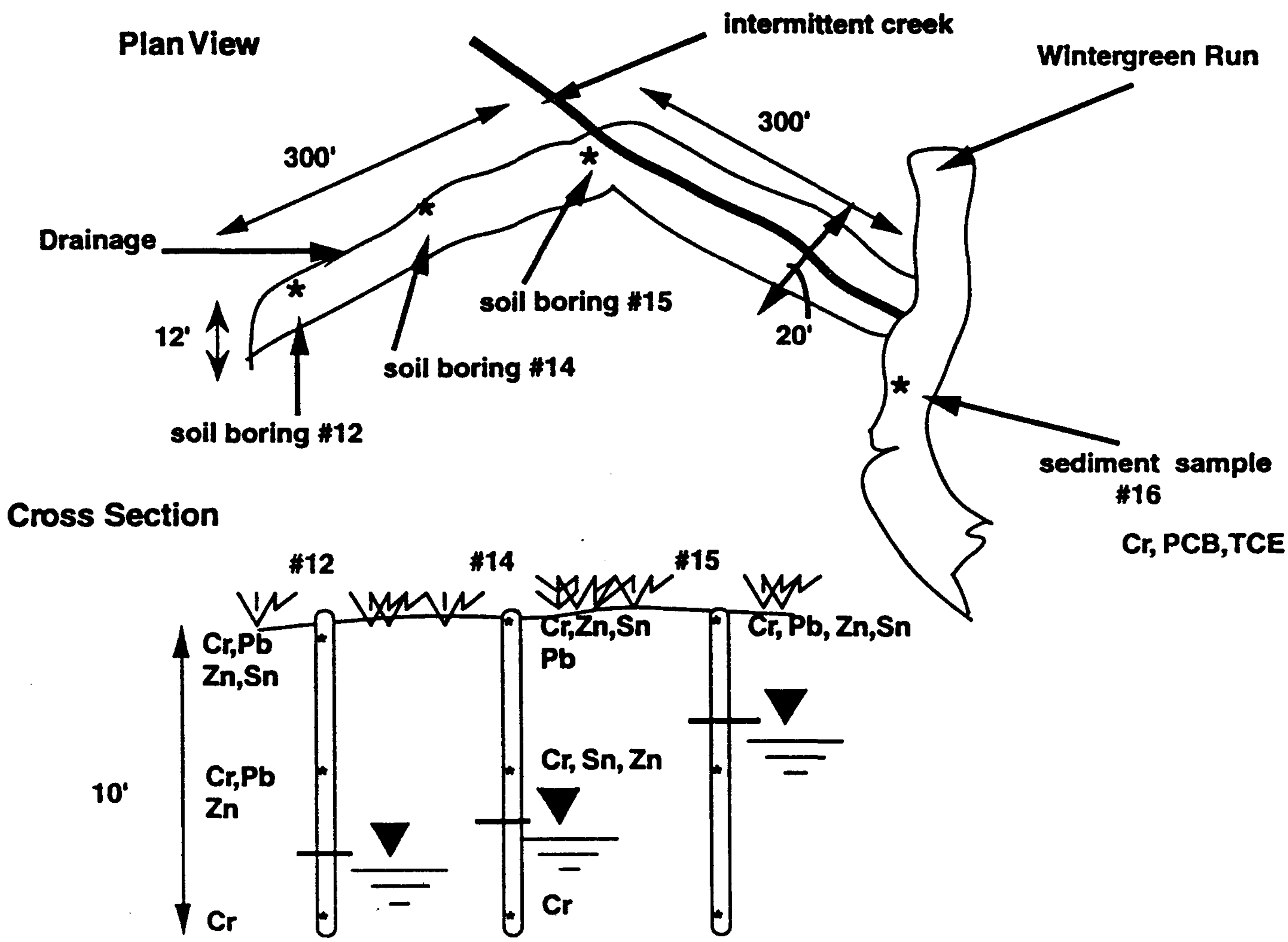
Samples were taken from soil boring 9 in the surface impoundment (Figure 2 and Figure 3). In the shallow sample taken of the top one foot of sand, TCE was found at 50,000 ppb (Reference 6). In the medium depth sample, taken below the clay layer and at a depth of 5 to 6 feet, no contamination was detected. The water table was

Figure 3: Surface Impoundment (Source 1)



encountered at 9 feet. The deep sample, taken at 10 to 11 feet, showed the presence of chloromethane (300 ppb), dichloroethene (DCE)(6,000 ppb), and TCE (20,000 ppb) (Reference 6).

Figure 4: Contaminated Soil Area I (Source 2)



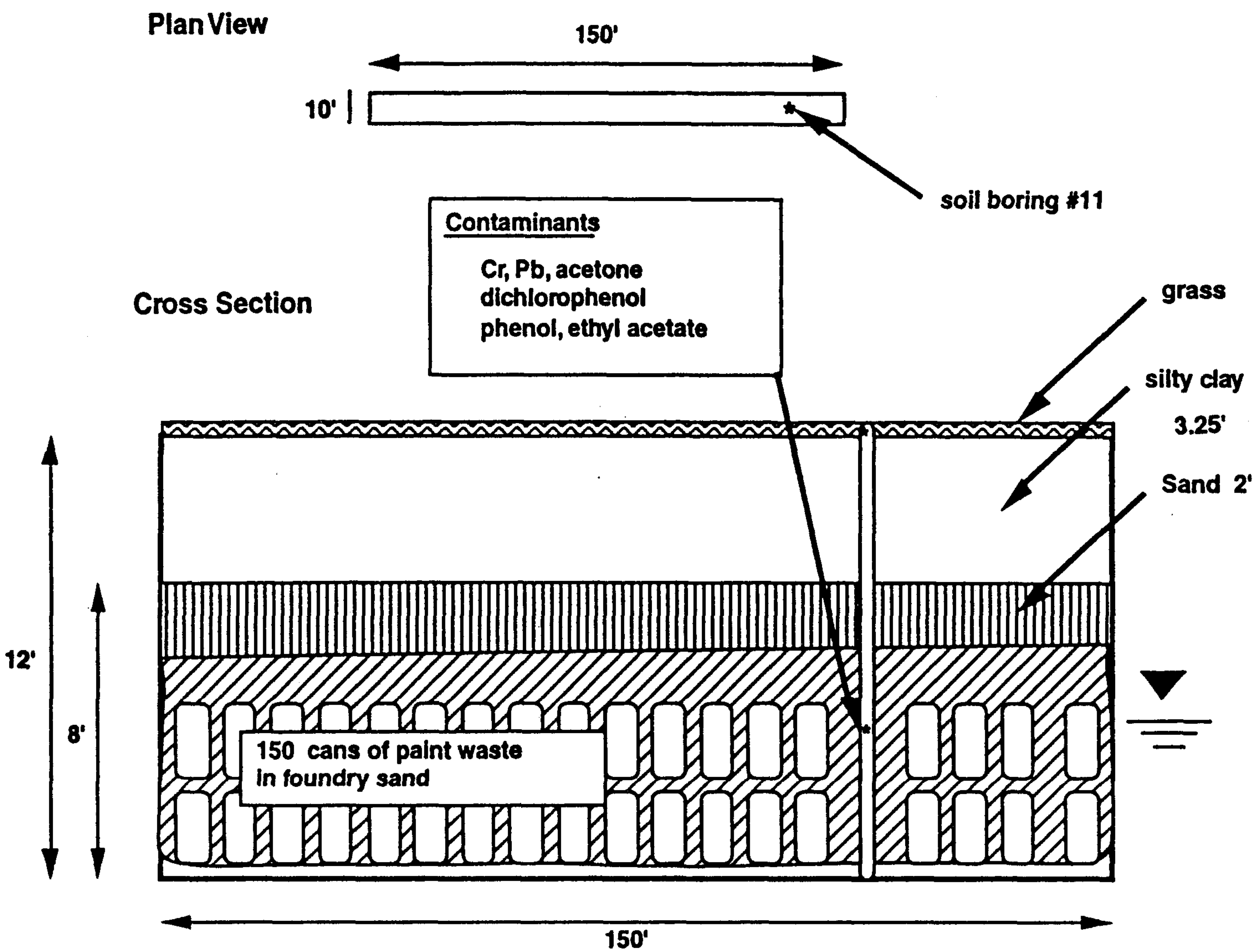
2.4.2 Contaminated Soil Area 1 (Source 2)

An area of discolored soil lies along the drainage ditch to the east of the parking lot, extending from the drainage tile under the driveway down into the intermittent creek. At the drainage tile, the soil was stained orange, which faded to green as distance from the drain increased. The bottom of the intermittent creek below the point of intersection with the ditch to the point of intersection with Wintergreen Run was also stained orange and no vegetation was visible on the rocks and gravel, in contrast with about 100 feet above the intersection. The concrete base of the building on the other side of the driveway was also stained and eroded. This portion of the building formerly contained the metal plating operation.

The area of staining is about 12 feet in width in the drainage ditch and up to 20 feet in width in the intermittent stream. The length of the drainage ditch is 300 feet and the intermittent stream is another 300 feet.

No organic vapors were detected by flame ionization detector/photoionization detector (FID/PID) in this area. Samples were taken from two borings and one surface location in the drainage ditch, sampling locations 12, 14, and 15 in Figures 2 and 4. Surface samples at these locations showed chromium, lead, tin, and zinc significantly elevated over local background; samples at 10 to 11 feet deep in the borings showed these metals at background levels.

Figure 5: Buried Trench (Source 3)



2.4.3 Buried Trench (Source 3)

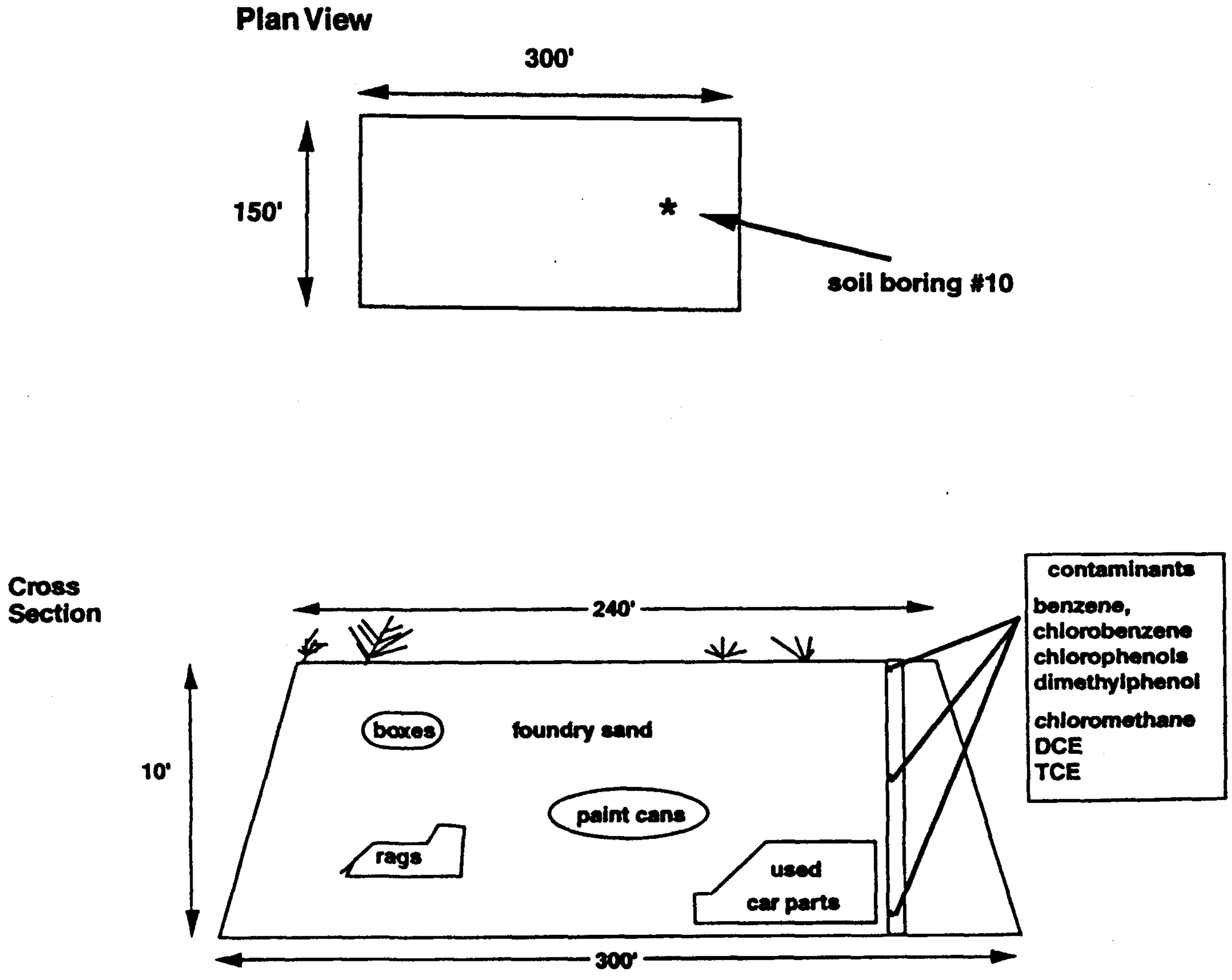
The trench was found as a depression in back of the facility near the waste pile (Figure 2). The dimensions of the depression are 150 feet by 10 to 12 feet (see Figure 5). The building maintenance workers mow the grass on this area regularly. No ditches or berms surround the area and no gas collection system was associated with the trench.

When State personnel attempted to take a boring in the depression, they repeatedly encountered what seemed to be the lids of metal drums at a depth of slightly more than 5 feet. The first 3¼ feet consisted of silty clay material. Below this was what appeared to be foundry sand extending to a depth of the deepest boring, 6 feet.

The trench was excavated, after the site inspection, under CERCLA removal authority. The Agency found 150 cans of paint wastes (2 feet by 3 feet) in the trench. Most had rusted along the seams where the lids were soldered on. This seems mainly to have occurred only in those cans placed upside down. The five open cans were full of paint wastes and smelled strongly of solvents. The removal team reported the presence of substances typically associated with paint sludge: ethyl acetate, acetone, kerosene, barium, lead chromate, and titanium. The total depth of the trench was 12 feet, about the same depth as the water table. The removal team noted that none of the substances found in the trench were found in the shallow ground water at nearby monitoring well MW-1 (Reference 6).

The shallow sample results from soil boring 11 in the buried trench (Figure 5) showed no contamination (Reference 6). The sample taken at 5 to 6 feet deep showed elevated levels of chromium, lead, and tin, and the presence of acetone, ethyl acetate, dichlorophenol, and phenol.

Figure 6: Waste Pile (Source 4)



2.4.4 Waste Pile (Source 4)

The dimensions of the pile, 300 by 150 feet, were found on the un-filed RCRA permit application. The pile extends about 10 feet above the surface and is basically trapezoidal in shape, with 30 percent slopes on its edges, extending to the soil surface (see Figure 6). The pile rests on native soil with no liner. This description is consistent with what was observed at the site inspection.

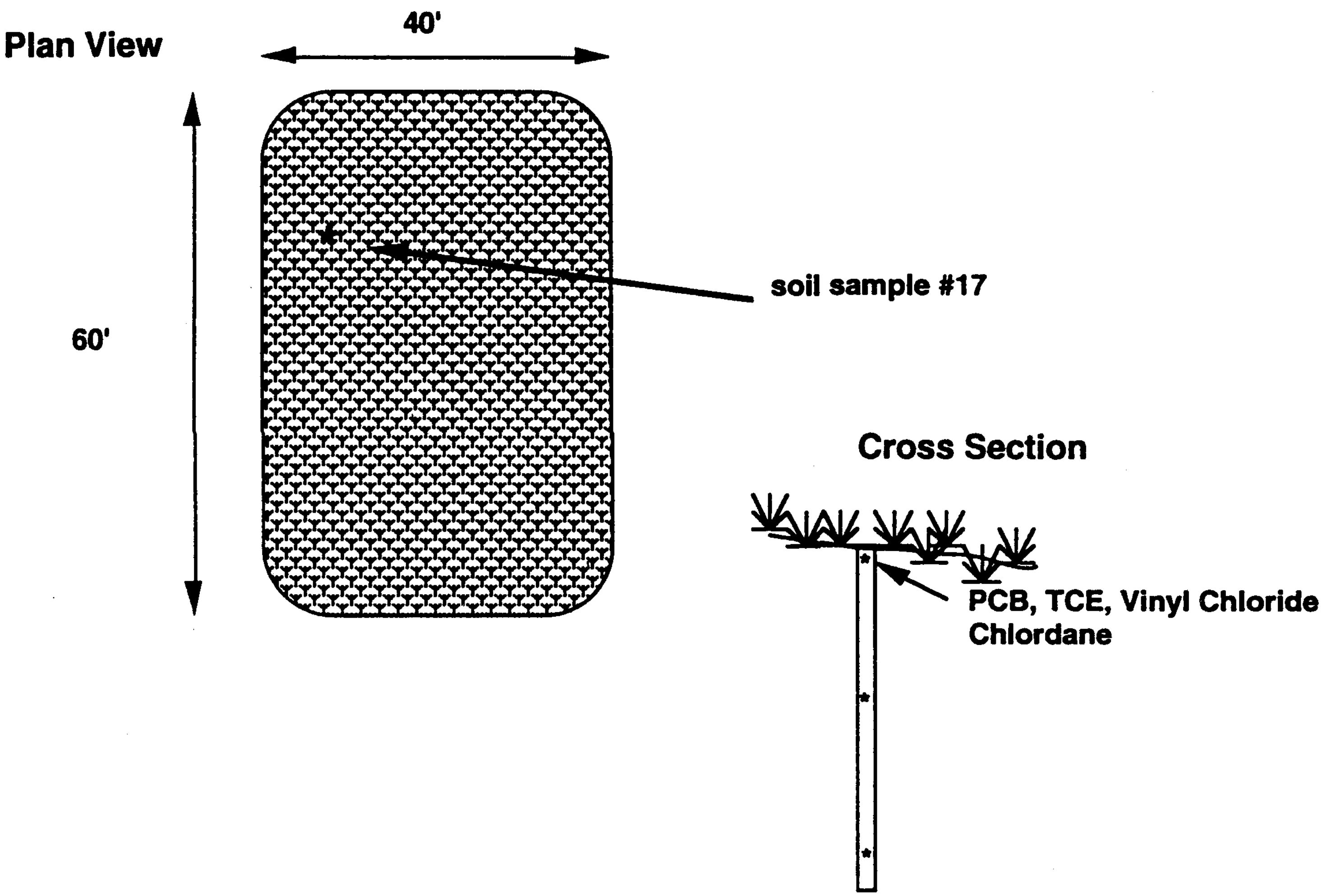
The cover material is sand which looks similar to that used in forming casts. The sides are extensively eroded and waste material is exposed. The top is covered by at least 2½ feet of sand and supports a sparse cover of vegetation. There are drainage ditches around the pile that are inspected weekly and repaired as necessary. There are no trees or other form of windbreak around the pile. No response from the biogas detector was observed during the site inspection.

When investigating the edges of the pile, State personnel reported that they could identify that the pile had been used for disposal of all types of solid waste, including 5-gallon containers (whose labels indicated they formerly contained chlorinated solvents and paint), cardboard boxes, metal shavings, rags, used car parts, and food containers.

Soil boring 10 was taken through the thickness of the pile (Figures 2 and 6). The sample results (Reference 6) show benzene, chlorobenzene, and dichlorophenol in the shallow sample (0 to 1 feet), chloromethane, DCE, and TCE at medium depth (5 to 6 feet) and chloromethane, chlorobenzene, dichlorobenzene, chlorophenol, dichlorophenol, 2,4-dimethylphenol, DCE and TCE at the depth of 10 to 11 feet. The drillers indicated organic smells and, based on the soil core log, the presence of ashes, suggesting that the pile formerly was burned.

Shallow ground water at RP-3 and RP-5 alongside the pile is contaminated with the same substances found in the pile (Figure 8 and Reference 6)

Figure 7: Contaminated Soil Area II (Source 5)



2.4.5 Contaminated Soil Area II (Source 5)

The second area of contaminated soil is an area about 60 feet by 40 feet (see Figure 7) at the sharp bend in the drive that leads to the loading dock for the truck maintenance facility (see Figure 2). The soil, naturally mottled grey, was stained almost pinkish in parts of the surface, but in other areas the soil was black. One small water puddle down-gradient from the main part of the area had an oily sheen. The FID/PID registered weak but detectable quantities of hydrocarbons in one part of the area, but the concentrations exceeded the limits of the instrument in other parts.

A notice of a spill of mixed contaminants, dated June 1989, was found in the company files. The notice explained that an open bed truck carrying containers of waste material for transport to the county disposal area (as part of a State-sponsored Community Cleanup Program) overturned on its way out of the facility, and an unknown amount of waste chemicals had been spilled. The sheet indicated that the wastes included organic solvents from the truck repair facility, PCB-contaminated oil from company transformers that had been refilled with PCB-free dielectric fluid, some cans labelled roach spray, and cans of paint waste from the maintenance shop. The notice of spill may not have been filed since the copy to be sent to the state was still attached.

Soil boring 17 was placed in this spill area (Figures 2 and 7). The sample results (Reference 6) show the presence of chlordane, PCB 1254, TCE, and vinyl chloride in the top 1 foot of soil.

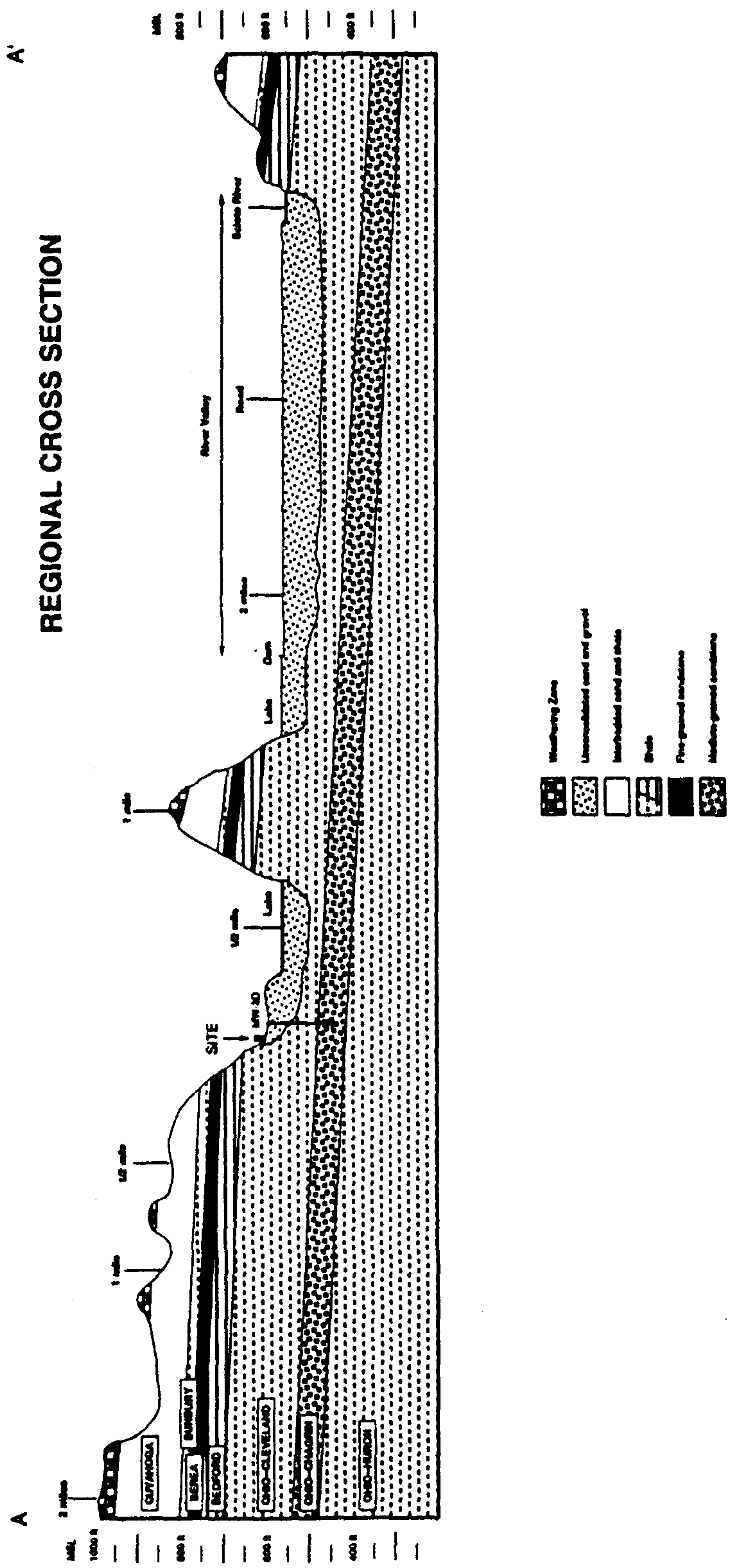
2.4.6 Other Wastestreams

A shipping manifest, dated 1979, was also found in the company files. The manifest was for the transport and disposal of 20 tons of casting sand. The manifest bore a stamp indicating that the material had been rejected for disposal at the county landfill, and an explanation that an EP toxicity test of the material found 20 parts per million of arsenic in it.

2.5 Conclusions

Author's Notes
Conclusions to be developed.

Figure 8: Regional Geological Cross-section



3. Ground Water Pathway

3.1 Hydrogeology

The facility is located 16 miles south of the edge of the Wisconsin glacial advance. There are two main features to the area: the dissected uplands of the unglaciated Kanawha (Allegheny) section of the Appalachian Plateaus Province and the broad river valleys that are deeply eroded into the uplands and contain sand and gravel glacial outwash. Small, meandering rivers now run through these valleys. The site is located directly over a portion of the glacial sand and gravel aquifer that extends into the area of Lake White(Reference 3 - USGS Topo Map and Reference 7 - Geological Cross-Section). See also Figure 8 for the Regional cross-section and Figure 9 for the local.

The stratigraphy for Pike County is:

Period	Formation/Member	Lithology	Thickness
Mississippian	Cuyohoga	sandstone & shale	340 ft.
	Sunbury	dark fissile shale	16 ft.
	Berea	sandstone	29 ft.
	Bedford	pinkish-grey shale	59 ft.
Devonian	Ohio/Cleveland	shale	165 ft.
	Ohio/Chagrin	sandstone	70 ft.
	Ohio/Huron	shale	210 ft.

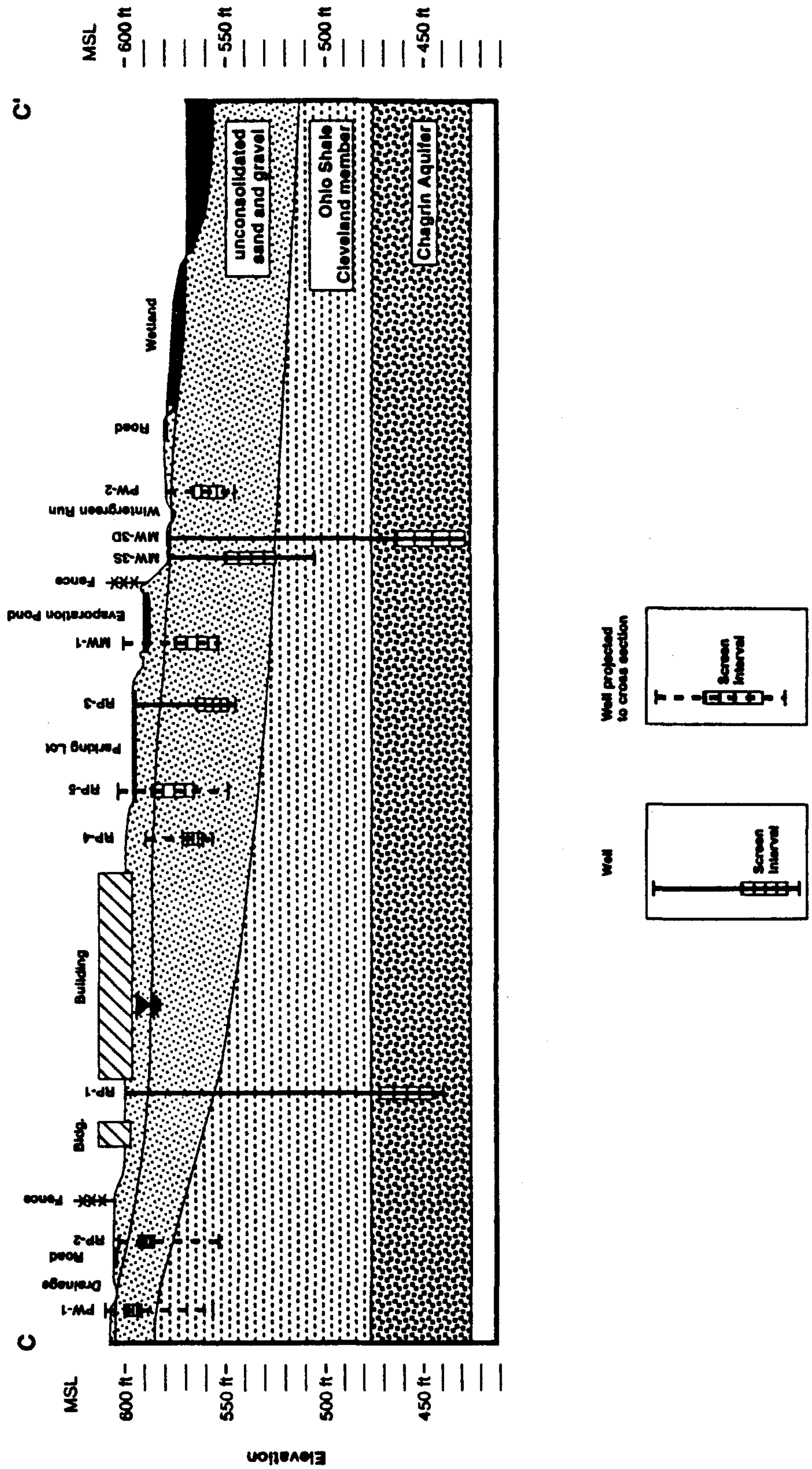
The glacial outwash valley is eroded into the Cleveland formation. Therefore, the site overlies the unconsolidated outwash aquifer which is up to 90 feet thick in the area, the Cleveland (a confining layer that is around 100 feet thick under the site), the Chagrin (which has some local use as an aquifer) and the Huron (a confining layer). The Berea is used as an aquifer in the uplands but does not underlie the facility.

The soils in the area are moderately fine-textured silt loams with rather low infiltration rates.

3.2 Targets

The locations of the public supply wells within the 4-mile target distance limit are shown as large black dots on the USGS topographic map (Reference 3). Irrigation wells are shown by smaller black dots. All public supply wells draw from the sand and gravel valley aquifer. The information gathered so far on each system is:

Figure 9: Local Cross-section



Lake White. The Lake White water supply system supplies the 1,100 residents around the lake from two wells located next to the Lake White State Park.

Piketon. The Piketon water supply system supplies a population of 2,860 from a wellfield of three wells located along the Scioto River.

Pike County. Pike County supplies rural residences in the uplands with water. This is done through two separate systems. The Ross well supplies 1,380 people and is located east of Waverly C and just within the 4-mile target distance limit. The Main Plant well supplies 3,020 people and is located on the west side of the Scioto River from the three Piketon wells.

Waverly. The Waverly water supply system supplies a population of 4,890 from 3 wells, Waverly A, B, and C. Well A is southeast of the city next to the intersection of Crooked Creek and Highway 23. Well B is directly south of the city by the sewage treatment facility lime ponds. The city also maintains, on a regular basis, a standby well next to Waverly B. Well C is northeast of the city, east of where Crooked Creek crosses Highway 23. The city engineer said that the wells have roughly the same pumping capacity. He noted that the city has never used surface water because the Scioto River is contaminated by storm/sewer runoff and industrial outfalls upstream at the town of Chillicothe.

Several **private wells** have also been identified. They are located at the residence just west of the site (PW-1 on Figure 9), at the trailer park just south of the site (PW-2), about ¾ mile west of the site along the intermittent stream where the location of an irrigation well is also shown (PW-9), and at the gasoline station at the intersection of county roads 220 and 228 (PW-10). The trailer park well supplies the residence of the owner and the trailers.

Information from the well logs for the private wells is:

Well ID	Total Depth	Surface Elevation	Water Level	Screened Interval
PW-1	58 ft.	618 ft. MSL	605 ft. MSL	580 - 600 ft. MSL
PW-2	33 ft.	578 ft. MSL	572 ft. MSL	550 - 565 ft. MSL
PW-9	25 ft.	745 ft. MSL	732 ft. MSL	720 - 730 ft. MSL
PW-10	27 ft.	583 ft. MSL	581 ft. MSL	556 - 565 ft. MSL

The Census states that the 1990 population per household in Pike County was 2.8.

3.3 Sample Locations

The ground water sampling locations are shown in Figure 10. The well logs for the wells that were sampled are found in Reference 8.

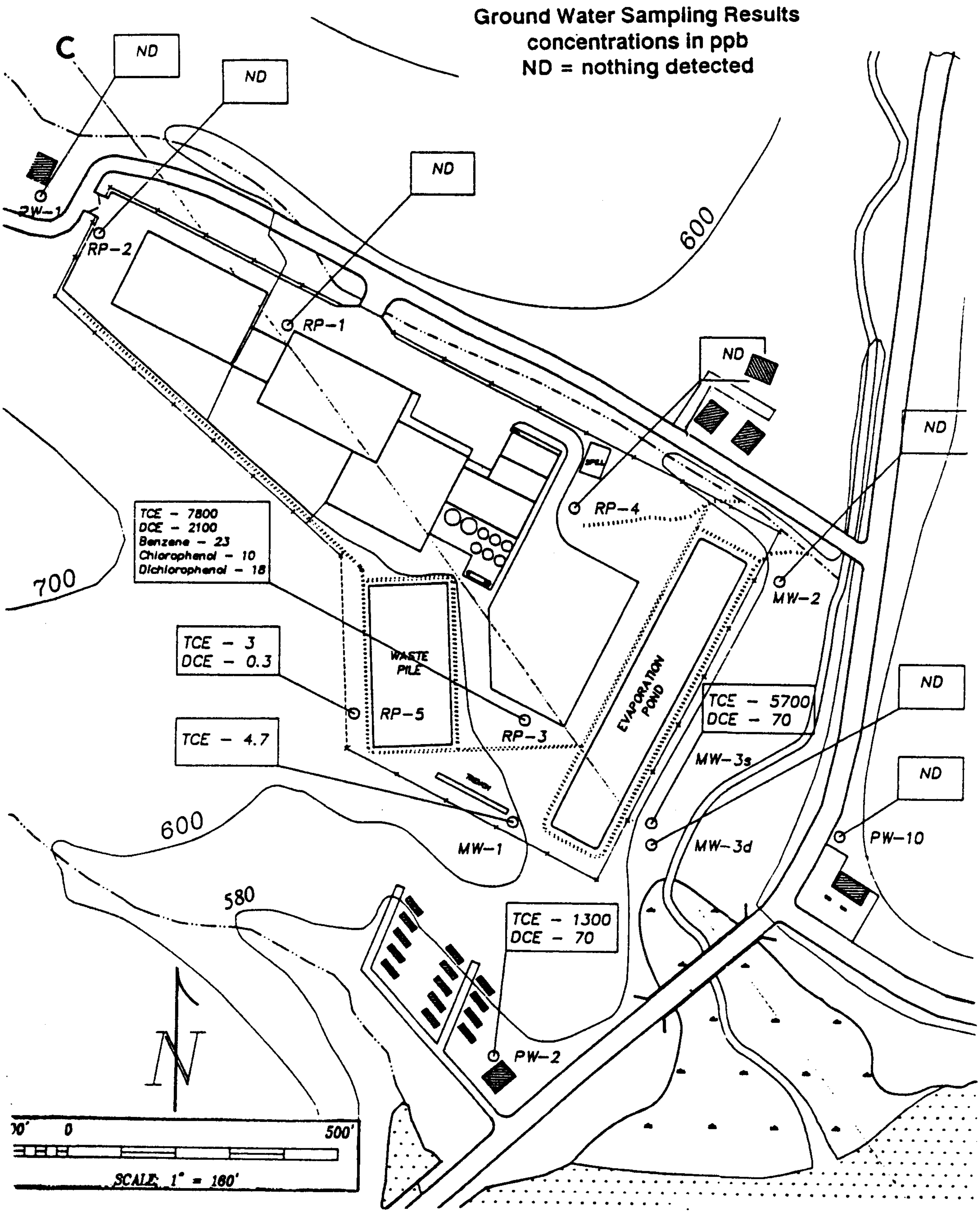
LPQ Auto Parts has five wells, RP-1 through RP-5. According to Mr. Leslie Quickstep, the current owner, these wells are used for process water and were never used for drinking water. RP-1 is 171 feet deep and is screened in the Chagrin (Reference 8). The other four wells range in depth from 29 to 59 feet and are screened in the unconsolidated sand and gravel aquifer. All five wells were sampled at the site inspection. The depths of these wells are depicted on figure 9 (page 18) and the concentrations of hazardous substances found in these wells are shown on figure 10 (page 21).

Four monitoring wells were placed during the site inspection. These wells, MW-1, MW-2, MW-3s, and MW-3d, were placed to the south and east of the facility to test the hypothesis that there is an observed release to ground water and to assess the threat to nearby private wells and the likelihood that contaminated ground water may discharge to surface water.

Monitoring wells MW-1, MW-2, and MW-3s range in depth from 45 to 66 feet and are screened in the unconsolidated sand and gravel aquifer. MW-3d is 139 feet deep and is screened in the Chagrin.

The three nearest private wells were also sampled at the site inspection. These are PW-1 to the west of the site and believed to be up-gradient, PW-2 at the trailer park just south of the site, and PW-10 at the gasoline station. These wells range in depth from 36 feet to 58 feet and are all screened in the unconsolidated sand and gravel aquifer. PW-2 and PW-10 were hypothesized to be primary targets in the preliminary assessment.

Figure 10: Site Map (Ground Water Sampling Locations)



3.4 Analytical Results

Author's Notes

The analytical results for the ground water samples are found in Reference 6 and are summarized in Figure 10.

- No contamination was detected in either well in the Chagrin aquifer (RP-1 and MW-3d).
- No contamination was detected in the shallow wells along the north and west of the site (RP-1, RP-2, RP-4, PW-1, and MW-2). Similarly, no contamination was detected in the shallow well at the gasoline station on the other side of Wintergreen Run.
- Contamination was found in all shallow wells that lie between the sources at the site and Lake White/Wintergreen Run.
- The most heavily contaminated well is RP-3, which lies between the waste pile, the evaporation pond, and the trench. The substances found were TCE (7800 ppb), DCE (2100 ppb), benzene (23 ppb), chlorophenol (10 ppb), and dichlorophenol (18 ppb).
- TCE and DCE were also found in RP-5 by the waste pile and MW-3s by the surface impoundment. TCE was found at 4.7 ppb in MW-1 next to the trench.
- The hypothesis that PW-2 at the trailer park is a primary target was confirmed by detections of TCE (1300 ppb) and DCE (70 ppb).

The sample quantitation limits for the substances found in ground water are: benzene (5 ppb), chlorophenol (10 ppb), dichlorophenol (10 ppb), DCE (5 ppb), and TCE (5 ppb).

3.5 Conclusions

Author's Notes

Conclusions to be developed.

4. Surface Water Pathway

4.1 Hydrology

The soils in the drainage area are moderately fine-textured silty loams with rather low infiltration rates. Most of the land is forested and is infrequently lumbered. The 2-year, 24-hour rainfall is 2.7 inches (Reference 5).

Hydrology information on each segment of the surface water pathway is as follows:

- **Wintergreen Run** drains 1,880 acres, an estimate made with graph paper and the USGS topo map. The average annual runoff is 20 inches per year (USGS Water Atlas, Plate 21). The Run is no more than 5-feet wide except where it enters the wetland at Lake White. The reach of the Run, from the confluence with the intermittent stream to Lake White, is ¼ mile.

- **Pee Pee Creek**, at its entry into Lake White, has an average annual flow of 45 cfs. The flow of Pee Pee Creek below the spillway from Lake White, after merging with Crooked Creek is 90 cfs. Between the spillway and the Scioto River, Pee Pee Creek averages 38 feet wide and is 5,800 feet long. This means the surface area is 5.1 acres (43,560 square feet per acre).

- The USGS collects discharge data along the **Scioto River** 1.2 miles north of Higby, which is north of Waverly. Average discharge over 58 years is 4,551 cfs. The river is an average of 375 feet wide. The length within the target distance limit is 11.75 miles (62,000 feet).

- **Lake White**, a 337-acre lake, was built in the 1930s. The lake is periodically dredged to maintain its depth profile of 25 to 30 feet in the middle and 10 to 15 feet nearer the shore. The dredge spoils have been placed at the upper end of the lake where Pee Pee Creek enters, near the upper boat landing, and along the peninsula in the middle of the lake. The distance from Wintergreen Run to the spillway is 2.1 miles.

4.2 Targets

4.2.1 Drinking Water Threat

According to the county health authorities, there are no drinking water intakes along the Scioto River. Before the Lake White water supply system was installed, some people may have drawn drinking water directly from Lake White rather than using shallow wells. This is no longer done.

The county agricultural agent said that, while there are a number of irrigation wells in the area, there are no irrigation intakes along Pee Pee Creek or the Scioto River.

Lake White is itself a State park and a major water recreation area. The on-land portion of the State park at the southern end of Lake White maintains a boat launch and a swimming beach.

Author's Notes

The floodplains around Lake White and Wintergreen Run are defined by the following elevations:

Annual	Up to 580 MSL
10-year	Up to 590 MSL
100-year	Up to 600 MSL
500-year	Up to 610 MSL

4.2.2 Human Food Chain Threat

Lake White is stocked with sockeye, also known as red salmon. The State fisheries biologist has estimated the yield or catch for Lake White to be 45 pounds per acre. This above-average catch is due to the stocking with salmon.

During the SI, a fisherman was observed casting into Lake White from the lake shore near the bridge across Wintergreen Run. He said that people catch pan fish and salmon near the bridge over Wintergreen Run in the spring and the fall.

The State biologist stated that the yield for **Pee Pee Creek** is probably about 5 pounds per acre and that the yield for the **Scioto River** is 11 pounds per acre.

4.2.3 Environmental Threat

Wintergreen Run passes through wetland at its confluence with Lake White. Also, local wetlands have developed along the shore east of the mouth of Wintergreen Run.

The entirety of **Lake White** is a managed fishery, a State-designated area for maintenance of aquatic life, and a State park. A portion of the lake along the southeastern shore opposite the state park has also been listed in the State's Clean Lakes Program as a critical habitat for a lake fishery under Section 314 of the Clean Water Act. The lake is stocked with sockeye. The terrestrial portion of the State park has a nature trail and a small nature center. No hunting is allowed in the park but it is not specifically designated as a wildlife management area. Wetlands in Lake White also exist near the mouth of Pee Pee Creek as it enters the lake and, locally, east of the dam. This frontage is indicated on the USGS topographic map (Reference 3). The total wetland frontage on Lake White has been estimated to be 5,050 feet.

Pee Pee Creek is being opened for canoe access by the State and the City of Waverly. Pee Pee Creek and the adjacent stretch of the Scioto River is considered a critical habitat for the survival of the Blue Sucker, which is listed as an endangered species by the State of Ohio because of over fishing. Pee Pee Creek has no designation under Section 305(a) of the Clean Water Act. About 2,000 feet of wetland frontage lies below the spillway along Pee Pee Creek.

Portions of the **Scioto River** are known to contain the Blue Sucker. The Scioto River has been designated as a managed fishery and has been restricted for use as industrial waste discharge receiving water under Section 305(a) of the Clean Water Act. About 44,000 feet of wetland frontage has been identified by State Department of Natural Resources personnel between the levees and the main river bed along the Scioto River and along major bends and oxbows in the river. This frontage is shown on Reference 3.

4.3 Sample Locations

The onsite and nearby soil sediment and water sample locations are shown on Figure 2. The more distant sediment samples are shown on Figure 11 on the next page.

- Soil samples 2 and 3 were taken up-gradient from the sources to document the background in the intermittent stream bed. No alternative up-gradient sources of contamination have been identified.

- Soil sample 15 was taken in the intermittent stream bed to document the extent of Source 2 and to show whether hazardous substances from other sources are migrating toward surface water.

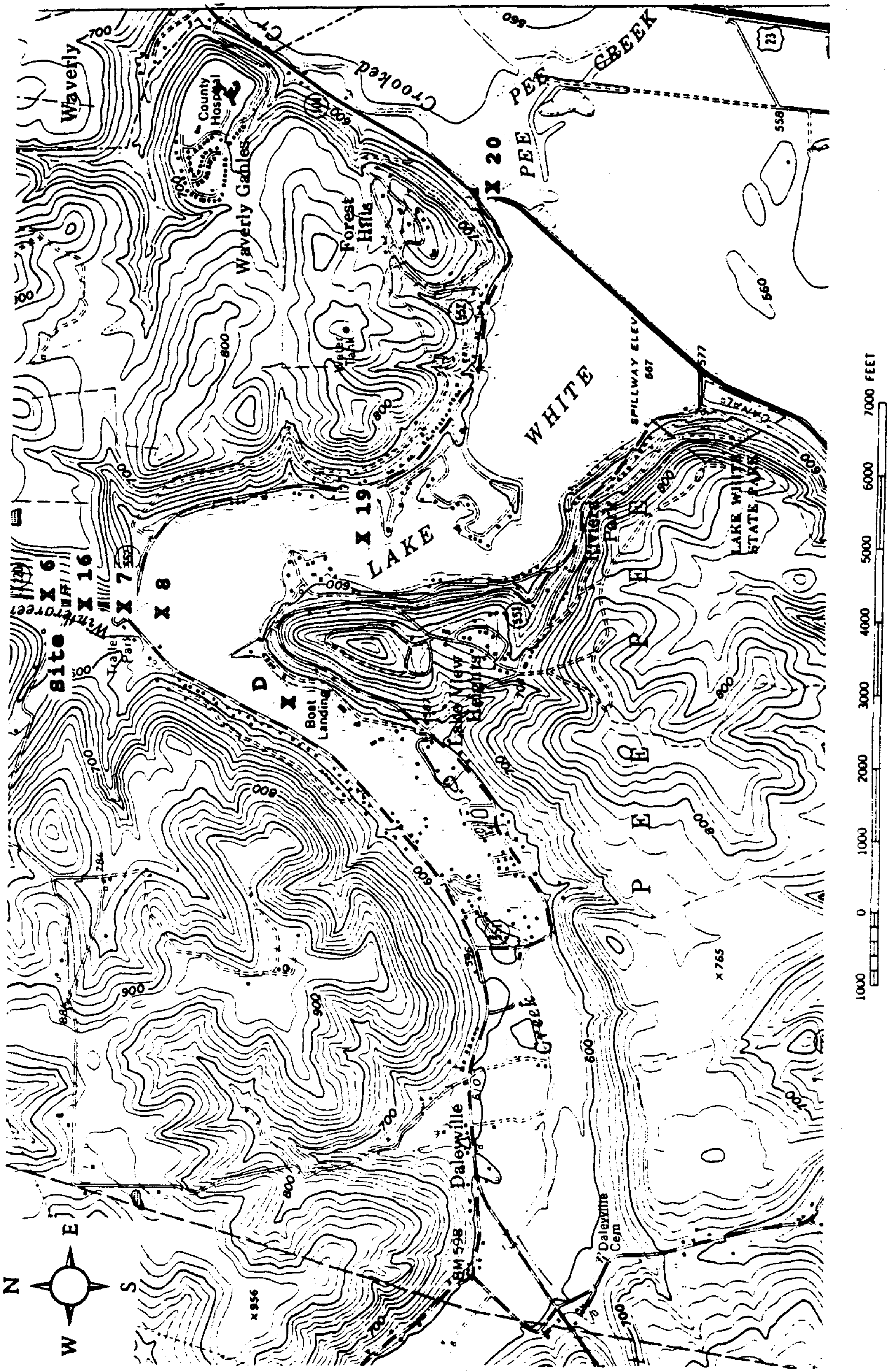
- Background water and sediment samples were taken from Wintergreen Run 400 feet upstream of the confluence with the intermittent stream (water sample ST-A and sediment sample 6).

- Aqueous samples to test the hypothesis of an observed release to surface water were taken at ST-B, just below the confluence of Wintergreen Run and the intermittent stream, and at the mouth of Wintergreen Run in Lake White (ST-B and ST-C).

- Downstream sediment samples were also taken at the following locations:

  -- 16: Just below the intermittent stream
  -- 7: Along the wetland frontage just below the bridge over Wintergreen Run
  -- 8: At the edge of the wetland where Wintergreen Run enters Lake White
  -- 19: In Lake White about 3,500 feet toward the spillway
  -- 20: In Pee Pee Creek just below the spillway

Figure 11: Site Map (Surface Water Sampling Locations)



A background sediment sample for Lake White was taken from the dredge spoils in the western branch of the lake toward the upper boat launch.

A fish tissue sample was obtained from a local fisherman who was observed casting into Lake White from the wetland at the confluence of Wintergreen Run and Lake White. He said that he had caught the pumpkin seed sunfish in the lake at this location.

4.4 Analytical Results

The analytical results are found in Reference 6 and are summarized here.

4.4.1 Sediment Samples

Hazardous Substance			Background Samples		Downstream Samples					Attribution Samples	
	Units	SQL	6s	Drdg.	16s	7s	8s	19s	20s	2s	3s
Chromium	ppm	0.02	26	na	4000	55	42	na	na	13	16
PCB 1254	ppb	80	nd	nd	33000	8000	9000	5000	nd	nd	nd
TCE	ppb	5	nd	na	37000	5300	1500	nd	nd	nd	nd
DCE	ppb	5	nd	na	nd	1000	70	nd	nd	nd	nd

na = not analyzed for, nd = analysis performed but not detected.

4.4.2 Surface Water Samples

Substance	Units	SQL	Background	Downstream	
			ST-A	ST-B	ST-C
TCE	μg/L	5	nd	300	18

4.4.3 Fish Tissue Sample

The fish tissue sample showed 23,000 ppb of PCB 1254. The SQL for the analysis was 80 ppb.

4.5 Conclusions

Author's Notes

Conclusions to be developed.

5. Air Pathway

5.1 Physical Conditions

Volatile organic substances were found in surface samples at the buried impoundment (sample 9s, Reference 6), in the waste pile (sample 10s), and in the area of contaminated soil where the truck is reported to have overturned (sample 17s). High but localized levels of hydrocarbons were detected by FID/PID in the area of contaminated soil.

Metals or organic substances likely to be entrained as particulate were found in the top foot of soil at the contaminated soil in the drainage ditch (sample 12s, 14s, and 15s), at the waste pile (sample 10s), and at the area of contaminated soil where the truck is reported to have overturned (sample 17s). No surficial contamination, however, was found is samples 13s or 18s taken near the waste pile.

No air samples were taken during the site inspection.

5.2 Targets

A survey of the number of residences within the 4-mile target distance limit has been completed. Because of the age of the USGS topographic map, the number of homes with ½ mile was field-verified during the SI. The number of homes by distance category is :

On a Source	0
>0 to 1/4 mile	26
>1/4 to 1/2 mile	23
>1/2 to 1 mile	164
>1 to 2 miles	475
>2 to 3 miles	1130
>3 to 4 miles	1030

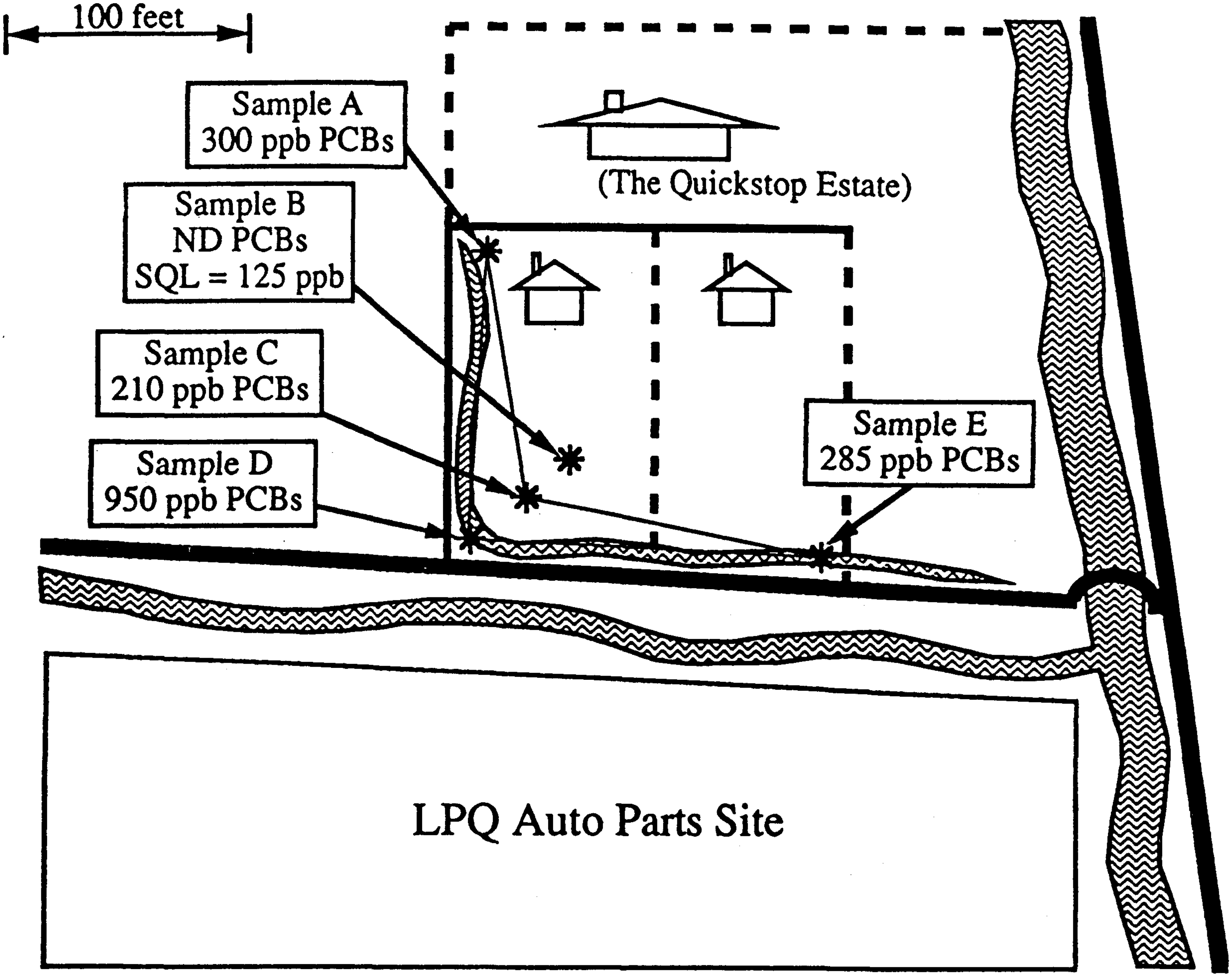
The number of persons per household in Pike County, reported in the 1990 Census, is 2.8.

All sensitive environments identified within the 4-mile target distance limit lie along the surface water hazardous substance migration path or the Scioto River. The acreage of wetlands is indicated on the USGS topographic map (Reference 3).

5.3 Conclusions

Author's Notes
Conclusions to be developed.

Figure 12: Quickstep Properties



6. Soil Exposure Pathway

Author's Notes

In a 1992 flood, water backed up from Wintergreen run into the intermittent stream and into the residential drainage system for the three houses directly north of the site via the culvert under the road. Because of the concerns raise by the finding of hazardous substances, particularly PCBs, in the intermittent stream at sampling point 15, five surface soil samples were taken from the residential properties and analyzed for PCBs.

Samples A, B, C, D, and E were taken on two of the residential properties directly north of the site.

6.1 Soil Sample Locations

The locations of the surficial soil sample are shown on Figure 2 on page 9 and Figure 12 on the opposite page.

- Surficial soil samples were taken at each of the five sources at the site: samples 9s, 10s, 11s, 12s, 14s, 15s, and 17s.
- Samples 1s and 2s were taken within the property boundary of the residence directly west of the site.
- Sample 4s was taken within the property boundary of the trailer park and within 200 feet of the 14 trailers.
- Samples 5s and 18s were taken offsite on the north and southwest sides of the facility and were intended to serve as backgrounds.
- Sample 3s was taken as an attribution sample (background) from the intermittent stream bed for the purposes of the surface water pathway.
- The surficial sample at location 13 was taken to see if there was evidence of wind entrainment of contaminated particulate from the waste pile.

6.2 Soil Sample Results

All sample results, except for the five recent samples for PCBs, are summarized in Reference 6.

Chlordane at 130 ppb was found on the property of the residence directly to the west of the site. Chlordane was also found at high concentrations onsite in sample 17s and in the intermittent stream bed in sample 15s.

Soil Exposure Pathway

No hazardous substances were detected in sample 4s on the property of the trailer park.

Author's Notes

The results for the five recent samples from the property of the two homes north of the site showed the presence of PCB 1254. The SQL for the samples are 125 ppb and the data was unqualified. The results are:

A	300 ppb
B	none detected
C	210 ppb
D	950 ppb
E	285 ppb

6.3 Targets

Author's Notes

Distance rings for the air pathway have not been modified for the soil exposure pathway to reflect area of contamination rather than sources. However, data for the air pathway appears to be good enough to estimate targets for soil exposure. The three additional homes to the north, directly across from the site, need to be considered for soil exposure targets.

6.4 Conclusions

Author's Notes

Conclusions to be developed.

Reference 2: SCDM
(Relevant Pages Only)

HAZARD RANKING SYSTEM
Hazardous Substance Benchmarks

		SOIL PATHWAY	
Substance Name	CAS Number	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Acetone	000067-64-1	5.8E+04	...
Aluminum	007429-90-5	...	...
Arsenic	007440-38-2	1.7E+02	3.3E-01
Barium	007440-39-3	4.1E+04	...
Benzene	000071-43-2	...	2.0E+01
Chlordane	000057-74-9	3.5E+01	4.5E-01
Chlorobenzene	000108-90-7	1.2E+04	...
Chloromethane	000074-87-3	...	4.5E+01
Chlorophenol, 2-	000095-57-8	2.9E+03	...
Chromium	007440-47-3	2.9E+03	...
Chromium (III)	016065-83-1	5.8E+05	...
Chromium (VI)	018540-29-9	2.9E+03	...
Cyanide	000057-12-5	1.2E+04	...
Dichloroethene, 1,1-	000075-35-4	5.2E+03	9.7E-01
Dichloroehtylene, cis-1,2-	000156-59-2	5.8E+03*	...
Dichloroehtylene, trans-1,2-	000156-60-5	1.2E+04	...
Dichlorophenol, 2,4-	000120-83-2	1.7E+03	...
Dimethyl phenol, 2,4-	000105-67-9	1.2E+04	...
Ethyl acetate	000141-78-6	5.2E+05	...
Iron	015438-31-0	...	...
Lead	007439-92-1	...	...
PCBs	001336-36-3	...	7.6E-02
Phenol	000108-95-2	3.5E+05	...
Trichloroethylene	000079-01-6	...	5.3E+01
Vinyl Chloride	000075-01-4	...	3.1E-01
Zinc	007440-66-6	1.7E+05*	...

* Indicates difference between previous version of chemical data (DEC91) and current version of chemical data.

HAZARD RANKING SYSTEM
Hazardous Substance Benchmarks

		AIR PATHWAY			GROUND WATER PATHWAY		
Substance Name	CAS Number	NAAQS/NESHAPS (ug/m3)	Reference Dose Screen Conc (mg/m3)	Cancer Risk Screen Conc (mg/m3)	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)
Acetone	000067-64-1	...	...	...	...	3.5E+00	...
Aluminum	007429-90-5	...	...	...	...	...	...
Arsenic	007440-38-2	...	...	2.3E-07	5.0E-02	1.1E-02	2.0E-05
Barium	007440-39-3	...	...*	...	2.0E+00*	2.5E+00	...
Benzene	000071-43-2	...	...	1.2E-04	5.0E-03	...	1.2E-03
Chlordane	000057-74-9	...	...	2.7E-06	2.0E-3*	2.1E-03	2.7E-05
Chlorobenzene	000108-90-7	...	...*	...	...	7.0E-01	...
Chloromethane	000074-87-3	...	...	5.6E-04	...	...	2.7E-03
Chlorophenol, 2-	000095-57-8	...	...	...	...	1.8E-01	...
Chromium	007440-47-3	...	...	...	1.0E-01*	1.8E-01	...
Chromium (III)	016065-83-1	...	...*	...	...	3.5E+01	...
Chromium (VI)	018540-29-9	...	...*	8.3E-08	...	1.8E-01	...
Cyanide	000057-12-5	...	...	...	2.0E-01*	7.0E-01	...
Dichloroethene, 1,1-	000075-35-4	...	...	2.0E-05*	7.0E-03	3.2E-01	5.8E-05
Dichloroehtylene, cis-1,2-	000156-59-2	...	...*	...	7.0E-02*	3.5E-01*	...
Dichloroehtylene, trans-1,2-	000156-60-5	...	...	...	1.0E-01*	7.0E-01	...
Dichlorophenol, 2,4-	000120-83-2	...	...	...	...	1.1E-01	...
Dimethyl phenol, 2,4-	000105-67-9	...	...	...	...	7.0E-01	...
Ethyl acetate	000141-78-6	...	...	...	...	3.2E+01	...
Iron	015438-31-0	...	...	...	...	...	...
Lead	007439-92-1	1.5E+00	...	...	...*	...	...
PCBs	001336-36-3	...	...	...	5.0E-04*	...	4.5E-06
Phenol	000108-95-2	...	...	...	...	2.1E+01	...
Trichloroethylene	000079-01-6	...	...	5.8E-04*	5.0E-03	...	3.2E-03
Vinyl Chloride	000075-01-4	...	...	1.2E05*	2.0E-03	...	1.8E-05

* Indicates difference between previous version of chemical data (DEC91) and current version of chemical data.

HAZARD RANKING SYSTEM
Hazardous Substance Benchmarks

Substance Name	CAS Number	SURFACE WATER PATHWAY: DRINKING WATER: MCL/MCLG (mg/L)	DRINKING WATER: Reference Dose Screen Conc (mg/L)	DRINKING WATER: Cancer Risk Screen Conc (mg/L)	FOOD CHAIN: FDAAL (ppm)	FOOD CHAIN: Reference Dose Screen Conc (mg/kg)	FOOD CHAIN: Cancer Risk Screen Conc (mg/kg)	ENVIRONMENTAL: AWQC/AALAC Freshwater (ug/L)	ENVIRONMENTAL: AWQC/AALAC Saltwater (ug/L)
Acetone	000067-64-1	...	3.5E+00	...	...	1.3E+02	...	...	...
Aluminum	007429-90-5	...	...	...	...	...	...	...	...
Arsenic	007440-38-2	5.0E-02	1.1E-02	2.0E-05	...	3.9E-01	7.4E-04	1.9E+02	3.6E+01
Barium	007440-39-3	2.0E+00	2.5E+00	...	...	9.1E+01	...	...	...
Benzene	000071-43-2	5.0E-03	...	1.2E-03	...	...	4.5E-02	...	...
Chlordane	000057-74-9	2.0E-03*	2.1E-03	2.7E-05	3.0E-01	7.8E-02	1.0E-03	4.3E-03	4.0E-03
Chlorobenzene	000108-90-7	...	7.0E-01	...	...	2.6E+01	...	...	...
Chloromethane	000074-87-3	...	...	2.7E-03	...	...	1.0E-01	...	...
Chlorophenol, 2-	000095-57-8	...	1.8E-01	...	...	6.5E+00	...	...	...
Chromium	007440-47-3	1.0E-01*	1.8E-01	...	...	6.5E+00	...	...	...
Chromium (III)	016065-83-1	...	3.5E+01	...	...	1.3E+03	...	2.1E+02	2.1E+02
Chromium (VI)	018540-29-9	...	1.8E-01	...	...	6.5E+00	...	1.1E+01	5.0E+01
Cyanide	000057-12-5	2.0E-01*	7.0E-01	...	...	2.6E+01	...	5.2E+00	1.0E+00
Dichloroethene, 1,1-	000075-35-4	7.0E-03	3.2E-01	5.8E-05	...	1.2E+01	2.2E-03	...	...
Dichloroehtylene, cis-1,2-	000156-59-2	7.0E-02*	3.5E-01*	...	...	1.3E+01*	...	...	...
Dichloroehtylene, trans-1,2-	000156-60-5	1.0E-01*	7.0E-01	...	...	2.6E+01	...	...	...
Dichlorophenol, 2,4-	000120-83-2	...	1.1E-01	...	...	3.9E+00	...	...	...
Dimethyl phenol, 2,4-	000105-67-9	...	7.0E-01	...	...	2.6E+01	...	...	...
Ethyl acetate	000141-78-6	...	3.2E+01	...	...	1.2E+03	...	...	...
Iron	015438-31-0	...	...	...	...	...	...	1.0E+03	1.0E+03
Lead	007439-92-1	...*	...	...	...	...	...	3.2E+00	5.6E+00
PCBs	001336-36-3	5.0E-04*	...	4.5E-06	...	...	1.7E-04	1.4E-02	3.0E-02
Phenol	000108-95-2	...	2.1E+01	...	...	7.8E+02	...	...	...
Trichloroethylene	000079-01-6	5.0E-03	...	3.2E-03	...	...	1.2E-01	...	...
Vinyl Chloride	000075-01-4	2.0E-03	...	1.8E-05	...	...	6.8E-04	...	...
Zinc	007440-66-6	...	1.1E+01*	...	...	3.9E+02*	...	1.1E+02	8.6E+01

* Indicates difference between previous version of chemical data (DEC91) and current version of chemical data.

HAZARD RANKING SYSTEM

Hazardous Substance Factor Values

			Ground Water Mobility						Bioaccumulation									
			Liquid		Non-Liquid		Persistence		Food Chain		Environmental		Ecotoxicity		Air Gas	Air Gas		
Substance Name	CAS Number	Toxicity	Karst	NonKarst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Migration	Mobility	Gas	Part
Acetone	000067-64-1	10	1.0E+00	1.0E+00	1.0E+00	1.0E+00	0.4000	0.0700	0.5	0.5	0.5	0.5	100	1	17	1.0000	Yes	No
Aluminum	007429-90-5	...	1.0E+00	...	...	...	1.0000	1.0000	50.0	50.0	500.0	500.0	10	10	NA	NA	No	Yes
Arsenic	007440-38-2	10000	1.0E+00	1.0E-02	1.0E+00	1.0E-02	1.0000	1.0000	5.0	500.0	50.0	500.0	10	100	NA	NA	No	Yes
Barium	007440-39-3	10	1.0E+00	1.0E-02	1.0E+00	1.0E-02	1.0000	1.0000	0.5	0.5	0.5	0.5	1	1	NA	NA	No	Yes
Benzene	000071-43-2	100	1.0E+00	1.0E+00	1.0E+00	1.0E+00	0.4000	0.4000	5000.0	5000.0	500.0	50000.0	10000	10000	17	1.0000	Yes	No
Chlordane	000057-74-9	10000	1.0E+00	1.0E-04	2.0E-03	2.0E-07	1.0000	1.0000	50000.0	50000.0	50000.0	500000.0	10000	10000	6	0.0020	Yes	Yes
Chlorobenzene	000108-90-7	100	1.0E+00	1.0E-02	1.0E+00	1.0E-02	0.0007*	.0700*	50.0	50.0	50.0*	50.0*	1000	1000	17	1.0000	Yes	No
Chloromethane	000074-87-3	10	1.0E+00	1.0E+00	1.0E+00	1.0E+00	0.0007	0.0700	5.0	5.0	5.0	5.0	1	1	17	1.0000	Yes	No
Chlorophenol, 2-	000095-57-8	100	1.0E+00	1.0E-02	1.0E+00	1.0E-02	0.4000	1.0000*	500.0	500.0	500.0	500.0	100	100	17*	1.0000	Yes	No
Chromium	007440-47-3	10000	1.0E+00	1.0E-02	1.0E+00	1.0E-02	1.0000	1.0000	5.0	500.0	5.0	500.0	10000	10000*	NA	NA	No	Yes
Chromium (III)	016065-83-1	1*	1.0E+00*	1.0E+00*	2.0E-05*	2.0E-05*	0.4000*	0.0700*	50000.0*	50000.0*	50000.0*	50000.0*	10	10	NA	NA	No	Yes
Chromium (VI)	018540-29-9	10000	1.0E+00*	1.0E-02*	...*	...*	1.0000	1.0000	5.0	500.0	5.0	500.0	100	100	NA	NA	No	Yes
Cyanide	000057-12-5	100	1.0E+00	...	...	...	0.4000	0.0700	0.5	0.5	0.5	0.5	1000	1000	NA	NA	No	Yes
Dichloroethene, 1,1-	000075-35-4	100	1.0E+00	1.0E-02	1.0E+00	1.0E-02	0.4000	1.0000	50.0	50.0	50.0	50.0	10	1	17	1.0000	Yes	No
Dichloroehtylene, cis-1,2-	000156-59-2	100	1.0E+00	1.0E+00	1.0E+00	1.0E+00	0.4000	1.0000	5.0	5.0	5.0	5.0	...	...	17	1.0000	Yes	No
Dichloroehtylene, trans-1,2-	000156-60-5	100	1.0E+00	1.0E+00	1.0E+00	1.0E+00	0.4000	1.0000	50.0	50.0	50.0	50.0	1*	1*	17	1.0000	Yes	No
Dichlorophenol, 2,4-	000120-83-2	1000	1.0E+00	1.0E-02	1.0E+00	1.0E-02	1.0000	0.4000	500.0	500.0	500.0	500.0	100*	100*	11	0.2000	Yes	Yes
Dimethyl phenol, 2,4-	000105-67-9	100	1.0E+00	1.0E-02	1.0E+00	1.0E-02	1.0000	1.0000	500.0	500.0	500.0	500.0	100	100	11	0.2000	Yes	Yes
Ethyl acetate	000141-78-6	1	1.0E+00	1.0E+00	1.0E+00	1.0E+00	0.4000	0.4000	0.5	0.5	0.5	0.5	1*	1*	17	1.0000	Yes	No
Iron	015438-31-0	...	1.0E+00	1.0E-02	1.0E+00	1.0E-02	1.0000	1.0000	0.5	0.5	0.5	0.5	10	10	NA	NA	No	Yes
Lead	007439-92-1	10000	1.0E+00	1.0E-02	2.0E-03	2.0E-05	1.0000	1.0000	50.0	5000.0	5000.0	5000.0	1000	1000	NA	NA	No	Yes
PCBs	001336-36-3	10000	1.0E+00*	1.0E-04*	2.0E-03*	2.0E-07*	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	10000	10000	11*	1.0000*	Yes*	No*
Phenol	000108-95-2	1	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0000	0.4000	5.0	5.0	5.0	5.0	10000*	100	11	1.0000	Yes	No
Trichloroethylene	000079-01-6	10	1.0E+00	1.0E-02	1.0E+00	1.0E-02	0.4000	1.0000	50.0	50.0	50.0	50.0	100*	10	17	1.0000	Yes	No
Vinyl Chloride	000075-01-4	10000	1.0E+00	1.0E-02	1.0E+00	1.0E-02	0.0007	0.0700	5.0	5.0	5.0	5.0	...	...	17	1.0000	Yes	No
Zinc	007440-66-6	10	1.0E+00	1.0E-02	2.0E-01	2.0E-03	1.0000	1.0000	500.0	50000.0	500.0	50000.0	10	100	NA	NA	No	Yes

* Indicates difference between previous version of chemical data (DEC91) and current version of chemical data.

Reference 6:
Summary of Sampling Results

Summary of Sample Results

> *Trainer's Note*
>
> *Summary tables of key sampling results should be included in the text of the SI report. In those tables, never mix ppm and ppb within the same table. For the references, attach the laboratory report, the QA/QC summary, and the chain of custody.*

Soil Sample Results[1]

		Soil Sample #1 House W of Site			Soil Sample #2 Intermittent Stream NW		
Substance	SQL	s	m	d	s	m	d
Aluminum	0.05	16000	15000	19000	18000		
Chromium	0.02	22	27	19	16		
Iron	0.01	22000	19000	23000	23000		
Lead	0.05	20	7	8	23		
Tin	0.02	0.7	0.1	0.3	1.2		
Zinc	0.01	35	32	38	15		
Acetone	10	-	-	-	-		
Benzene	5	-	-	-	-		
Chlordane	80	-	-	-	130		
Chlorobenzene	5	-	-	-	-		
Chloromethane	10	-	-	-	-		
Chlorophenol	330	-	-	-	-		
Dichlorobenzene	330	-	-	-	-		
Dichloroethene	5	-	-	-	-		
Dichlorophenol	330	-	-	-	-		
2,4-dimethylphenol	330	-	-	-	-		
Ethyl Acetate	10	-	-	-	-		
Phenol	330	-	-	-	-		
PCB 1254	80	-	-	-	-		
Trichloroethylene	5	-	-	-	-		
Vinyl Chloride	10	-	-	-	-		

1 Metals are reported in ppm, organics in ppb.
"-" = analysis performed but none detected,
" " = analysis not performed.
s = 0 - 1 ft deep,
m = 5 - 6 ft deep,
d = 10 - 11 ft deep.

Substance	SQL	Soil Sample #3 Intermittent Stream s	m	d	Soil Sample #4 Trailer Park to South s	m	d
Aluminum	0.05	14500			15400	13800	17000
Chromium	0.02	13			19	23	25
Iron	0.01	25000			19000	18000	21000
Lead	0.05	29			12	9	7
Tin	0.02	0.5			0.1	0.7	0.5
Zinc	0.01	33			33	36	29
Acetone	10	-			-	-	-
Benzene	5	-			-	-	-
Chlordane	80	-			-	-	-
Chlorobenzene	5	-			-	-	-
Chloromethane	10	-			-	-	-
Chlorophenol	330	-			-	-	-
Dichlorobenzene	330	-			-	-	-
Dichloroethene	5	-			-	-	-
Dichlorophenol	330	-			-	-	-
2,4-dimethylphenol	330	-			-	-	-
Ethyl Acetate	10	-			-	-	-
Phenol	330	-			-	-	-
PCB 1254	80	-			-	-	-
Trichloroethylene	5	-			-	-	-
Vinyl Chloride	10	-			-	-	-

Substance	SQL	Soil Sample #5 North of Site s	m	d	Soil Sample #9 Surface Impoundment s	m	d
Aluminum	0.05	16800	12500	14000	17000	23000	19000
Chromium	0.02	27	24	28	22	19	25
Iron	0.01	26000	23000	24000	34000	20000	23000
Lead	0.05	22	7	4	13	10	8
Tin	0.02	0.8	0.9	0.6	0.3	0.5	0.2
Zinc	0.01	24	29	32	26	22	19
Acetone	10	-	-	-	-	-	-
Benzene	5	-	-	-	-	-	-
Chlordane	80	-	-	-	-	-	-
Chlorobenzene	5	-	-	-	-	-	-
Chloromethane	10	-	-	-	-	-	300
Chlorophenol	330	-	-	-	-	-	-
Dichlorobenzene	330	-	-	-	-	-	-
Dichloroethene	5	-	-	-	-	-	6000
Dichlorophenol	330	-	-	-	-	-	-
2,4-dimethylphenol	330	-	-	-	-	-	-
Ethyl Acetate	10	-	-	-	-	-	-
Phenol	330	-	-	-	-	-	-
PCB 1254	80	-	-	-	-	-	-
Trichloroethylene	5	-	-	-	50000	-	20000
Vinyl Chloride	10	-	-	-	-	-	-

Substance	SQL	Soil Sample #10 Waste Pile s	m	d	Soil Sample #11 Buried Trench s	m	d
Aluminum	0.05	30000	19000	20000	19000	32000	
Chromium	0.02	48	27	28	22	85	
Iron	0.01	34000	30000	25000	23000	35000	
Lead	0.05	23	9	10	8	65	
Tin	0.02	0.9	0.5	0.8	0.5	1.8	
Zinc	0.01	140	33	27	28	32	
Acetone	10	-	-	-	-	800	
Benzene	5	350	-	-	-	-	
Chlordane	80	-	-	-	-	-	
Chlorobenzene	5	575	-	550	-	-	
Chloromethane	10	-	700	1400	-	-	
Chlorophenol	330	-	-	200	-	-	
Dichlorobenzene	330	-	-	400	-	-	
Dichloroethene	5	-	12500	18000	-	-	
Dichlorophenol	330	200	-	-	-	400	
2,4-dimethylphenol	330	-	-	630	-	-	
Ethyl Acetate	10	-	-	-	-	5000	
Phenol	330	-	-	-	-	600	
PCB 1254	80	-	-	-	-	-	
Trichloroethylene	5	-	35000	48000	-	-	
Vinyl Chloride	10	-	-	-	-	-	

Substance	SQL	Soil Sample #12 Drainage Ditch s	m	d	Soil Sample #13 N of Buried Trench s	m	d
Aluminum	0.05	35000	29000	20000	15000	17000	12000
Chromium	0.02	15000	7000	100	27	20	23
Iron	0.01	40000	32000	18000	40000	23000	23000
Lead	0.05	2000	270	7	9	3	17
Tin	0.02	1400	10	0.4	0.5	0.7	0.8
Zinc	0.01	800	52	30	38	30	29
Acetone	10	-	-	-	-	-	-
Benzene	5	-	-	-	-	-	-
Chlordane	80	-	-	-	-	-	-
Chlorobenzene	5	-	-	-	-	-	-
Chloromethane	10	-	-	-	-	-	-
Chlorophenol	330	-	-	-	-	-	-
Dichlorobenzene	330	-	-	-	-	-	-
Dichloroethene	5	-	-	-	-	-	10000
Dichlorophenol	330	-	-	-	-	-	-
2,4-dimethylphenol	330	-	-	-	-	-	-
Ethyl Acetate	10	-	-	-	-	-	-
Phenol	330	-	-	-	-	-	650
PCB 1254	80	-	-	-	-	-	-
Trichloroethylene	5	-	-	-	-	-	38000
Vinyl Chloride	10	-	-	-	-	-	-

Substance	SQL	Soil Sample #14 Drainage Ditch s	m	d	Soil Sample #15 Intermittent Stream s	m	d
Aluminum	0.05	13000	20300	16800	11800		
Chromium	0.02	10000	2000	65	8000		
Iron	0.01	38000	32000	23000	32000		
Lead	0.05	3000	35	6	7000		
Tin	0.02	1100	3	0.8	300		
Zinc	0.01	300	38	28	100		
Acetone	10	-	-	-	-		
Benzene	5	-	-	-	-		
Chlordane	80	-	-	-	15000		
Chlorobenzene	5	-	-	-	-		
Chloromethane	10	-	-	-	-		
Chlorophenol	330	-	-	-	-		
Dichlorobenzene	330	-	-	-	-		
Dichloroethene	5	-	-	-	15000		
Dichlorophenol	330	-	-	-	-		
2,4-dimethylphenol	330	-	-	-	-		
Ethyl Acetate	10	-	-	-	-		
Phenol	330	-	-	-	-		
PCB 1254	80	-	-	-	51000		
Trichloroethylene	5	-	-	-	75000		
Vinyl Chloride	10	-	-	-	-		

Substance	SQL	Soil Sample #17 Spill Area II s	m	d	Soil Sample #18 W of Waste Pile s	m	d
Aluminum	0.05	15000	14500	17000	14800	17600	12340
Chromium	0.02	23	24	19	19	23	21
Iron	0.01	23000	26000	30000	23000	14000	21500
Lead	0.05	23	5	7	8	5	3
Tin	0.02	0.5	0.3	0.8	0.7	0.4	0.4
Zinc	0.01	35	23	31	22	32	29
Acetone	10	-	-	-	-	-	-
Benzene	5	-	-	-	-	-	-
Chlordane	80	250000	-	-	-	-	-
Chlorobenzene	5	-	-	-	-	-	-
Chloromethane	10	-	-	-	-	-	-
Chlorophenol	330	-	-	-	-	-	-
Dichlorobenzene	330	-	-	-	-	-	-
Dichloroethene	5	-	-	-	-	-	-
Dichlorophenol	330	-	-	-	-	-	-
2,4-dimethylphenol	330	-	-	-	-	-	-
Ethyl Acetate	10	-	-	-	-	-	-
Phenol	330	-	-	-	-	-	-
PCB 1254	80	180000	-	-	-	-	-
Trichloroethylene	5	200000	-	-	-	-	-
Vinyl Chloride	10	2000	-	-	-	-	-

Sediment Sample Results[2]

Substance	SQL	6s	7s	8s	16s
Aluminum	0.05	19000	18500	19000	17000
Chromium	0.02	26	55	42	4000
Iron	0.01	20000	22000	20500	35000
Lead	0.05	28	19	22	60
Tin	0.02	1.0	1.2	0.9	0.9
Zinc	0.01	33	38	39	33
Chlordane	80	-	-	-	-
Dichloroethene	5	-	1000	70	-
PCB 1254	80	-	8000	9000	33000
Trichloroethylene	5	-	5300	1500	37000

Substance	SQL	19s	20s	Dredge
Chlordane	80	-	-	
Dichloroethene	5	-	-	
PCB 1254	80	5000	-	-
Trichloroethylene	5	-	-	

[2] Metals are reported in ppm, organics in ppb.
"-" = analysis performed but none detected.
" " = analysis not performed.
s = 0 - 1 ft deep,
m = 5 - 6 ft deep,
d = 10 - 11 ft deep.

Surface Water Sample Results[3]

Substance	SQL	ST-A	ST-B	ST-C
Acetone	10	-	-	-
Benzene	5	-	-	-
Chlordane	0.05	-	-	-
Chlorobenzene	5	-	-	-
Chloromethane	10	-	-	-
Chlorophenol	10	-	-	-
Dichlorobenzene	10	-	-	-
Dichloroethene	5	-	-	-
Dichlorophenol	10	-	-	-
2,4-dimethylphenol	10	-	-	-
Ethyl Acetate	10	-	-	-
Phenol	10	-	-	-
PCB 1254	1	-	-	-
Trichloroethylene	5	-	300	18
Vinyl Chloride	10	-	-	-

[3] Analytical results are reported in $\mu g/L$.
"-" = analysis performed but none detected.

Ground Water Sample Results[4]

Substance	SQL	MW-1	MW-3s	PW-2	RP-3	RP-5
Acetone	10	-	-	-	-	-
Benzene	5	-	-	-	23	-
Chlordane	0.05	-	-	-	-	-
Chlorobenzene	5	-	-	-	-	-
Chloromethane	10	-	-	-	-	-
Chlorophenol	10	-	-	-	10	-
Dichlorobenzene	10	-	-	-	-	-
Dichloroethene	5	-	70	70	2100	0.3
Dichlorophenol	10	-	-	-	18	-
2,4-dimethylphenol	10	-	-	-	-	-
Ethyl Acetate	10	-	-	-	-	-
Phenol	10	-	-	-	-	-
PCB 1254	1	-	-	-	-	-
Trichloroethylene	5	4.7	5700	1300	7800	3
Vinyl Chloride	10	-	-	-	-	-

[4] All wells shown on Figure 10 were sampled.
No contamination was found in MW-2, MW-3d, PW-1, PW-10, RP-1, RP-2, or RP-4.
Analytical results are reported in $\mu g/l$.
"-" = analysis performed but none detected.