Environmental Resources Management

EMBARCADERO COVE
REMEDIAL INVESTIGATION
SECOND PHASE
HEALTH AND SAFETY PLAN

PORT OF OAKLAND
OAKLAND, CALIFORINA

Prepared by:

ERM-West
Walnut Creek, CA 94596

January 29, 1988

ERM-West
Environmental Resources Management

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Reply To:

Walnut Creek

January 29, 1988

Ms. Denise Kato
Department of Health Services
5850 Shell Mound Road
Emeryville, CA 94608

Dear Ms. Kato:

Enclosed for your review is the proposed Health and Safety Plan for the Phase Two Remedial Investigation of the Port of Oakland Embarcadero Cove site. This revision responds to the comments presented at our meeting with Department of Health Services personnel on December 7, 1987.

We look forward to your review and approval of this document. If you have any questions, please contact me.

Yours truly,

ERM-WEST

Stephen J. Nelson, P.E.
Principal

SJN/293

Enclosure - Noted

cc: California Regional Water Quality Control Board, San Francisco Region - Attention: Donald Dalke
Alameda County Health Department - Attention: Rafat Shahid
Port of Oakland - Attention: Neil Werner

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HEALTH AND SAFETY PLAN

This document is the ERM-West Health and Safety Plan for the the Phase II Remedial Investigations at the Embarcadero Cove Marina site. Potential hazards, protective measures, and Health and Safety Program implementation are presented in detail. Adherence to this document will be required of all ERM-West personnel and subcontractors working at the site.

POTENTIAL HAZARDS AND PROTECTIVE MEASURES

The field investigations to be performed at the Embarcadero Cove site present potential safety hazards to personnel working at the site and to persons in public areas near the site. These dangers result from worker exposure to chemicals, workplace hazards, and potential off-site movement of chemicals. These hazards and appropriate mitigation measures are presented below.

Worker Hazards

The on-site safety program is designed to protect personnel from direct contact, inhalation, or ingestion of potentially hazardous materials that may be encountered at the site. The safety program is also prepared to provide personnel with information on first aid and the location of local medical facilities, in the event of medical emergency.

The Embarcadero Cove site is located on the central water front of Oakland, California. The site was leased by the Port of Oakland to a number of industrial concerns for 60 to 70 years. On-site activities included handling of refined petroleum products, wood preservatives, pesticides and herbicides. Industrial activities at the site ceased in 1970.

Exposure to Chemicals. Areas of subsurface soil and shallow groundwater contain moderate to high levels of several synthetic organic chemicals. The predominant constituent accounting for the highest concentrations found in both soils and groundwaters is pentachlorophenol (PCP). In addition, isolated areas of subsurface soils were found to contain the pesticides chlordane, dieldrin, and DDT and its breakdown products, while some groundwater samples contained low levels of toluene, xylenes, DDD and PCBs. Low levels of dioxins and furans, apparently associated with the PCP, have been detected in on-site soils and groundwaters, but the forms of these compounds of greatest health concern (tetrachlorodibenzodioxin and tetrachlorodibenzofuran) have not been detected in any samples tested.

The only observed off-site migration of any of these constituents has been trace (<15 ppb) levels of PCP in shallow groundwaters. The absence of significant off-site migration is likely due to the low overall permeability of soils at the site and the isolated occurrences of the contaminants themselves. There is low potential for direct human exposure due to the isolated nature of the contamination, the absence of any nearby potable water withdrawals, the restricted access to the site itself, and the lack of significant off-site contamination. Exhibit A includes selected tables and figures from a previous report[1] describing the occurrence patterns and concentrations of chemicals previously detected. Information regarding the toxicity of the above-mentioned substances will be disseminated at the initial site safety meeting and will be available on-site (see Table 1). Dust control will be achieved by wetting the ground

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1. "Feasibility Study Report for Embarcadero Cove Marina Site, Oakland, California," prepared by ERM-West, March 2, 1987

TABLE 1 - CONSTITUENTS IDENTIFIED AND HAZARD EVALUATION

Constituent	Occurrence Pattern	Routes of Exposure	Health Effects(1) Symptoms	Target Organ	Permissible Exposure Limit in Air(1)	First Aid(1)	Personal Protective Methods(1)
acetone	Groundwater: low to high concentrations in 5 wells (10 to 50-foot depth). Concentrations decreased with time to non-detectable levels in in all wells. Soil : not detected.	Inhalation Ingestion Absorption Skin and eye contact	Irritation of eyes, nose and throat; headaches, dizziness and dermatitis.	Respiratory system and skin.	EPA - 1000 ppm ACGIH (1983/84) - 750 ppm TWA STEL - 1000ppm IDLH - 20,000 ppm	Eye contact - irrigate immediately. Skin contact - wash with soap immediately. If inhaled large quantities, move the exposed person to fresh air at once and perform artificial respiration. If ingested, get medical help. Give large quantities of water & induce vomiting. Do not make unconscious person vomit.	Appropriate clothing to prevent skin contact. Eye protection to prevent contact. Wash promptly when skin is wet. Remove clothing promptly if wet/contaminated to avoid flammability hazard. Provide emergency shower and eyewash.
chlordane	Groundwater: initial analyses indicated low levels in 3 wells (10-25 foot depth). Not detected in most recent analyses (10/85). Soil: low to moderate concentrations in upper 5 feet.	Inhalation Ingestion Absorption Skin and eye contact	Blurred vision, confusion, ataxia, delirium, coughing, abdominal pain, nausea, vomiting, diarrhea, irritation, tremors, convulsions.	Central nervous system, eyes, lungs, liver, kidneys, skin.	EPA & ACGIH (1983/84) - 0.5 mg/m3. Skin absorption possible (ACGIH) IDLH - 500 mg/m3 STEL - 2.0 mg/m3	Eye contact - irrigate immediately. Skin contact - wash with soap immediately. If inhaled large quantities, move the exposed person to fresh air at once and perform artificial respiration. If ingested, get medical help. Give large quantities of water & induce vomiting. Do not make unconscious person vomit.	Appropriate clothing to prevent skin contact. Eye protection to prevent any reasonable probability of contact. Wash immediately when skin is wet/contaminated. Work clothing should be changed daily if it is possible that it is contaminated. Remove nonimpervious clothing immediately if wet/contaminated. Provide emergency shower and eyewash.
DDD (derivative of DDT)	Groundwater: low to moderate concentrations in 3 wells (10 to 25-foot depth). Soil: not detected.	Inhalation Ingestion Absorption Skin and eye contact	Irritation of eyes & skin, headaches, dizziness, malaise, convulsions.	Central nervous system, eyes, lungs, liver, kidneys, skin, peripheral nervous system.	No standards set.	Eye contact - irrigate immediately. Skin contact - wash with soap immediately. If inhaled large quantities, move the exposed person to fresh air at once and perform artificial respiration. If ingested, get medical help. Give large quantities of water & induce vomiting. Do not make unconscious person vomit.	Wear appropriate clothing to prevent any possibility of skin contact. Eye protection to prevent any reasonable probability of contact. Wash immediately when skin is wet/contaminated. Work clothing should be changed daily if it is possible that it is contaminated. Remove nonimpervious clothing immediately if wet/contaminated. Provide emergency shower and eyewash.
Dieldrin	Groundwater: low concentrations in one well (10 to 17-feet deep). Soil: low to moderate concentrations in isolated areas (0 to 4-foot depth).	Inhalation Ingestion Absorption Skin and eye contact	Headaches, dizziness, nausea, vomiting, malaise.	Central nervous system, liver kidneys, skin.	EPA & ACGIH (1983/84) - 0.25 mg/m3. Skin absorption EPA & ACGIH (1983/84) IDLH - 450 mg/m3 STEL - 0.75 mg/m3	Eye contact - irrigate immediately. Skin contact - wash with soap immediately. If inhaled large quantities, move the exposed person to fresh air at once and perform artificial respiration. If ingested, get medical help. Give large quantities of water & induce vomiting. Do not make unconscious person vomit.	Wear appropriate clothing to prevent any possibility of skin contact. Eye protection to prevent any reasonable probability of contact. Wash immediately when skin is wet/contaminated. Work clothing should be changed daily if it is possible that it is contaminated. Remove nonimpervious clothing immediately if wet/contaminated. Provide emergency shower and eyewash.

TABLE 1 - CONSTITUENTS IDENTIFIED AND HAZARD EVALUATION

Constituent	Occurrence Pattern	Routes of Exposure	Health Effects(1) Symptoms	Health Effects(1) Target Organ	Permissible Exposure Limit in Air(1)	First Aid(1)	Personal Protective Methods(1)
Dioxins /Furans	Groundwater: penta through octachloro forms present at moderate to high levels in 3 wells (10 to 25-foot depth); tetrachloro form not detected. Soil: moderate concentrations in at least one area at 2 to 8 foot depth; maximum concentration at 5 to 6-foot depth. Occurence profile follows that of PCP.	Inhalation Ingestion Absorption Skin and eye contact	Not Available	Not Available	Not available	Not Available	Not Available
Isopropanol	Groundwater: low to high concentrations in 2 wells (10 to 18-foot depth) detected in 1982. Not detected in subsequent analyses. Soils: not detected.	Inhalation Ingestion Absorption Skin and eye contact	Irritation of eyes and skin; narcosis.	Eyes, skin, respiratory system.	EPA & ACGIH (1983/84) TWA - 400 ppm NIOSH - 400 ppm workplace TWA - 800 ppm as ceiling conc. for 10 hr/d & 40 hr/week. IDLH - 20,000 ppm STEL - 500 ppm	Eye contact - irrigate immediately. Skin contact - flush with water immediately. If inhaled large quantities, move the exposed person to fresh air at once and perform artificial respiration. If ingested, get medical help. Give large quantities of saltwater & induce vomiting. Do not make unconscious person vomit.	Appropriate clothing to prevent skin contact. Eye protection to prevent contact. Wash promptly when skin is wet. Remove clothing promptly if wet/contaminated to avoid flammability hazard.
PCB (Arochlor 1260)	Groundwater: low concentrations in 1 deep well (38 to 48-foot depth).	Inhalation Ingestion Absorption Skin and eye contact	Irritation of eyes, nose and throat; headaches, chloracne, nausea, vomiting, abdominal pain, and fatigue	Skin, eyes, and liver.	EPA & ACGIH (1983/84) TWA - 0.5 mg/m3(54% Cl) - 1.0 mg/m3(42% Cl) IDLH - 5 mg/m3(54% CL) IDLH - 10 mg/m3(42% CL) STEL - 1.0 mg/m3(54% CL) STEL - 2.0 mg/m3(42% CL)	Eye contact - irrigate immediately. Skin contact - flush with water immediately. If inhaled large quantities, move the exposed person to fresh air at once and perform artificial respiration. If ingested, get medical help. Give large quantities of saltwater & induce vomiting. Do not make unconscious person vomit.	Wear appropriate clothing to prevent any possibility of skin contact. Eye protection to prevent any reasonable probability of contact. Wash immediately when skin is wet/contaminated. Remove nonimpervious clothing immediately if wet/contaminated.
Pentachloro-phenol (PCP)	Groundwater: low to high concentrations in 7 wells (5 to 23-foot), low concentrations in 2 wells (38 to 48-foot depth) Soils: widespread occurrence (0to 10-foot depth). Maximum concentration at 4 to 8-foot depth.	Inhalation Ingestion Absorption Skin and eye contact	Irritation of eyes, nose and throat; sneezing and coughing, weakness, weight loss, sweating, head-aches, nausea, vomiting, dermatitis.	Cardiovascular & respiratory system, liver kidneys, skin, eyes & central nervous system.	EPA & ACGIH (1983/84) TWA - 0.5 mg/m3. Skin absorption possible (ACGIH) IDLH - 150 mg/m3 STEL - 1.5 mg/m3	Eye contact - irrigate immediately. Skin contact - wash with soap immediately. If inhaled large quantities, move the exposed person to fresh air at once and perform artificial respiration. If ingested, get medical help. Give large quantities of water	Wear appropriate clothing to prevent any possibility of skin contact. Eye protection to prevent any reasonable probability of contact. Wash immediately when skin is wet/contaminated. should be changed daily if it is possible that it is contaminated. Remove nonimpervious clothing

TABLE 1 - CONSTITUENTS IDENTIFIED AND HAZARD EVALUATION

Constituent	Occurrence Pattern	Routes of Exposure	Health Effects(1) Symptoms	Health Effects(1) Target Organ	Permissible Exposure Limit in Air(1)	First Aid(1)	Personal Protective Methods(1)
PCP (continued)						& induce vomiting. Do not make unconscious person vomit.	immediately if wet/contaminated. Provide emergency shower and eyewash.
Toluene	Groundwater: low concentrations in 1 well (11 to 17-foot depth). Soil: not detected.	Inhalation Ingestion Absorption Skin and eye contact	irritation of eyes nose and throat. headaches, dizziness and dermatitis. fatigue, muscular weakness, drowsiness.	Central nervous system, liver, kidneys, skin.	EPA - 200 ppm 8 hr TWA with acceptble ceiling conc of 300 ppm. ACGIH (1983/84) - 100 ppm TWA NIOSH - 10 ppm TWA STEL - 150 ppm IDLH - 2000 ppm	Eye contact - irrigate immediately. Skin contact - wash with soap immediately. If inhaled large quantities, move the exposed person to fresh air at once and perform artificial respiration. If ingested, get medical help. Do not induce vomiting.	Appropriate clothing to prevent skin contact. Eye protection to prevent contact. Wash promptly when skin is wet. Remove clothing promptly if wet/contaminated to avoid flammability hazard.
Xylenes	Groundwater: low to moderate concentrations in 2 wells (10 to 23-foot depth). Soils: not detected.	Inhalation Ingestion Absorption Skin and eye contact	irritation of eyes nose and throat. headaches, dizziness and dermatitis nausea, vomiting and abdominal pain.	Central nervous system, liver, kidneys, skin, eyes, blood, gastrointestinal tract.	EPA & ACGIH (1983/84) TWA - 100 ppm NIOSH - 100 ppm workplace TWA for 10 hr/d & 40 hr/week. IDLH - 10,000 ppm STEL - 150 ppm	Eye contact - irrigate immediately. Skin contact - wash with soap immediately. If inhaled large quantities, move the exposed person to fresh air at once and perform artificial respiration. If ingested, get medical help. Do not induce vomiting.	Appropriate clothing to prevent skin contact. Eye protection to prevent contact. Wash promptly when skin is wet. Remove clothing promptly if wet/contaminated to avoid flammability hazard.

Notes: (1). HANDBOOK OF TOXIC AND HAZARDOUS CHEMICALS AND CARCINOGENS - SECOND EDITION, Sittig, Marshall (Noyes Publications, Park Ridge, New Jersey) 1985

around the drill rig and site activities.

Subsurface investigations have been conducted at the site since 1981. There is no record of injuries or accidents on the site since that time.

Workplace Hazards. There are relatively few workplace hazards anticipated for the groundwater investigation, but the soil boring and monitoring well procedures may include potential hazards other than those of a mechanical nature. See Table 2 for an analysis of these hazards.

Off-Site Movement of Chemicals

The potential for off-site movement of chemicals during site investigation activities presents a hazard to members of the public. Table 3 summarizes these hazards and the appropriate control measures.

TABLE 2

HAZARD ANALYSIS

JOB	TASK	MECHANICAL	ELECTRICAL	CHEMICAL	TEMPERATURE	ACOUSTICAL	O_2 DEFICIENCY
(1)	Soil Boring and Monitoring Well Installation	Trip and fall hazards	From undergound utilities - must be cleared prior to drilling	Exposure to contaminants	Possible heat stress	Possible from drilling	No (No Confined Space Entry)
(2)	Groundwater Investigation	Trip and fall hazards	No	"	"	No	No

TABLE 3

CONTROL MEASURES FOR OFF-SITE MOVEMENT OF CHEMICALS

Method of Transport	Activities Creating Hazard	Appropriate Control Measures
Wind blown dust	Drilling Activities	Wetting of surface soils before and during drilling
Vehicular Tracking	Vehicular Egress	Cleaning and decontamination of all vehicles and equipment leaving the site.
Waste Disposal	All	Segregation of contaminated wastes from non-contaminated wastes, with disposal of contaminated waste as hazardous waste.
Wastewater Discharge	Well Development and sampling	Containment of wastewater in tanks or drums, followed by disposal in accordance with regulatory requirements.

HEALTH AND SAFETY PROGRAM IMPLEMENTATION

ERM-West has developed a comprehensive Health and Safety training program to protect its staff and comply with OSHA requirements. Exhibit B is a sample of the Health and Safety manual ERM-West provides to all its field working employees. A synopsis of the components of the ERM-West Health and Safety program is given below.

General ERM-West Health and Safety Program

All employees who work on-site will have successfully completed the following components in compliance with OSHA regulations:

Health and Safety Manual and Videotape - Will introduce ERM employees to general health and safety protocols and specific ERM health and safety policies and procedures.

Medical Monitoring Program - Baseline, annual, and termination examinations will be performed to determine employee's ability to use personal protective equipment and identify job-related deviations in an employee's health. Medical and work histories will also be thoroughly documented for all employees.

Respiratory Protection Program - Will provide routine inspection and maintenance of employee's respiratory protective equipment; will ensure employee's respiratory protective equipment is functioning at optimum efficiency through fit testing and proper selection.

Instrument Operation Training - Employees will be instructed on proper use and care of monitoring instruments to ensure

instrument reliability and operation, as well as proper data interpretation.

First Aid/CPR Training - Field employees will be trained in first aid as required by 29 CFR 1910.151. CPR will be provided on a voluntary basis, although it is strongly recommended for all field personnel.

Site Safety Training/Site Health and Safety Plan - Site health and safety plan will be required prior to start-up of field activities. Health and safety plan will serve as training tool for reducing /eliminating exposure to site-specific hazards. Pre-activity safety meetings will ensure site personnel understand procedures to be followed during field operations.

Personnel Qualification and Experience Review - Field employee's qualifications and experience will be reviewed to determine level of training an individual has received through work experience and studies/courses.

Personnel Interview and Documentation - Field personnel will be interviewed to determine and document understanding of general health and safety protocols and to ensure proper training materials were received.

Introductory Training - Will be provided to those employees whose qualifications or experience do not meet standards necessary to safely perform field activities, as determined by qualifications and experience review. (40 hours off-site, 24 hours on-site).

Annual Refresher Training - Minimum of eight hours update training will be provided annually to review general field

health and safety protocols and to inform employees of changes, additions, etc., regarding health and safety procedures.

Supplemental Information - Pertinent information regarding health and safety will be distributed to appropriate personnel. Reference material will be made available for individual study.

Project Manager Update - Eight hours training in project management and technical safety skills will be required.

Contractor Compliance - Subcontractors will be required to certify their compliance with 1910:120.

All training will be documented and retained in employee files for 30 years after the employee leaves ERM-West.

Site Specific Program

Site specific Health and Safety procedures are needed in addition to the general Health and Safety Program requirements. These elements of the program are described below.

Responsibilities. The Project Manager will be responsible for ensuring that this Safety Plan is implemented prior to the start of field work. The Safety Officer will provide as much assistance to the Project Manager or his/her designee as is required to implement the Safety Plan. The Project Manager will distribute the Plan to all personnel involved in the project. The Project Manager will be responsible for ensuring that the Safety Plan is distributed to all subcontractors who may be involved in the project and that subcontracted personnel are briefed as

necessary for implementation of the Plan. The ERM Health and Safety Manual will be available for use by all on-site personnel.

When more than one ERM employee is to be present at the job site, a single employee shall be designated by the Project Manager as the Site Safety Officer. The Site Safety Officer will be responsible for insuring that the Safety Plan is being followed. When only one ERM employee is present, that employee will automatically be designated as the Site Safety Officer. The names and phone numbers of ERM-West staff members who may be scheduled for field work at the site are listed in Table 4.

Personnel Protection. This Safety Plan was prepared by reviewing the results of analyses of soil and groundwater samples in several previous investigations at the site. These investigations indicate a generally low level of risk to the health and safety of on-site workers. However, exposure to chemical hazards is possible. In addition, the drilling activities involve the use of mechanical construction machinery of significant size and power.

Based on previous site experience and studies, personnel protection will focus principally on preventing direct skin contact with soil and groundwater and on preventing inhalation of organic vapors. Accordingly, the minimum level of protection required for on-site personnel will be Level D. Level C protection will be used if excessive concentrations of organic vapors are detected and/or when dust cannot be controlled by wetting during drilling operations. In such situations, the respirators required in Level C protection will be used by all field personnel. These protective clothing requirements are summarized below.

Table 4

ERM-West Field Personnel

Name	Responsibility	Telephone Number
Jeff Rubin	ERM-West Health and Safety Officer	(415)946-0455
Stephen Nelson	Principal-in-Charge	(415)946-0455
Richard Knapp	Project Manager	(415)946-0455
Arun Chemburkar	Field Scientist	(415)946-0455
Dan Cutugno	Field Scientist	(415)946-0455
Kristin Hazard	Field Scientist	(415)946-0455
Catie Helm	Field Scientist	(916)635-7766
Don Landeck	Field Scientist	(415)946-0455
Don Lapin	Field Scientist	(415)946-0455
Ben Leslie-Bole	Field Scientist	(415)946-0455
Lori Pettegrew	Field Scientist	(415)946-0455
John Prall	Field Scientist	(415)946-0455
Cheryl Seath	Field Scientist	(415)946-0455
Bob Harding	Field Scientist	(714)476-3040
Victoria Provenza	Field Scientist	(714)476-3040
Linda Inaba	Field Scientist	(916)635-7766
William Spong	Field Scientist	(916)635-7766

All on-site personnel:

Hard hat
Tyvek, polyethylene tyvek, or saranex coveralls (disposable); selection will based on potential skin contact hazards: in areas where solvents and free hydrocarbons have previously been detected, polyethylene tyvek or saranex will be required.
Surgical gloves
Butyl gloves
Neoprene boots, steel toe
Safety goggles
All boot/coverall and glove/coverall seams shall be taped

If greater than 5 ppm organics vapors are indicated:

One-half face respirator (3M:7200 & 7300, NIOSH approval code: TC-23C-690)
Organic/acid vapor gas cartridges (3M:7253)

Steam Clean Personnel:

Face shield or goggles to guard against splash.

More information on the selection and required features of the various protection levels is contained in the ERM-West Health and Safety Manual. All personnel will have their own fit-tested respirator and will be trained in the use of the respirator equipment.

Air monitoring for organic vapors will be conducted upwind and downwind of the site with an HNU photoionization detector and/or an organic vapor analyzer (OVA) during drilling activities

to evaluate the distribution and occurrence of any organic vapors. Monitoring of PCP associated with airborne particles will be conducted during drilling operations in accordance with procedures described in NIOSH Manual of Analytical Methods-1979 Edition (Volume 1, #230 and Volume 4, #297). If feasible, the field collection will be conducted using portable, battery-powered pumps with intakes located near breathing levels, similar to devices used for detection of airborne asbestos in workplace environments. Alternatively, a high volume air sampler located immediately downwind of the drilling areas will be used during days when drilling operations are being conducted on-site.

Site Ingress/Egress. The work site will be divided into zones of contamination and predetermined decontamination areas. The following work zones will be delineated and clearly communicated to all workers:

- The exclusion zone in which work is being performed and the highest level of protection is required.

- The contaminant reduction zone, which is a buffering zone between the exclusion zone and the decontamination area. There will be limited access to this zone.

- The support zone, where equipment and personnel are decontaminated.

Specific ingress and egress procedures will be established on-site at the initial Health and Safety meeting.

Decontamination Procedures. All personnel and equipment exiting the site will undergo decontamination in the support zone. Personnel decontamination procedures are described in Chapter 6 of the ERM-West Health and Safety Manual. Drilling equipment will be

steam cleaned. Other equipment will be steam cleaned and/or decontaminated following the same procedures used for cleaning sampling equipment between sampling events.

Tyvek suits, gloves, and other contaminated solid wastes will be sealed in garbage bags, drummed, and disposed of as hazardous wastes. Uncontaminated wastes will be segregated and deposited in municipal trash receptacles. Bailer string will be similarly disposed.

Washwater generated during decontamination will be retained on-site in 55-gallon drums. Upon completion of the sampling effort, a composite sample of the water will be collected and sent for analysis. If the wash water is shown to be hazardous, it will be disposed of accordingly. If the wash water is non-hazardous, it will be disposed of in the sanitary sewer system.

First Aid. On-site personnel will be informed of the symptoms related to major exposure to significant concentrations of the types of chemicals found on-site. Immediate symptoms include irritation of the eyes, nose, and skin, headache, dizziness, lightheadedness, uncoordination, nausea, vomiting, and eventually unconsciousness. In the event that any on-site personnel experience such ill effects, operations will be stopped, and medical attention will be obtained for the individual as required. First aid for chemical exposure is as follows.

Direct Contact:

Skin - Remove contaminated clothing immediately. Flush affected area immediately with ample amounts of water, then wash with soap and water.

Eyes - Hold the eyelid open and flush with copious amounts of water.

Because first aid for skin and eye exposure requires water, a 5-gallon container of fresh water will be available on-site. A pressure spray container filled with fresh water will also be available and serve as an eye wash, as necessary.

Inhalation

Remove the individual to fresh air immediately; give artificial respiration as necessary.

Emergency Contacts and Facilities. In case of a major exposure of medical emergency, staff will obtain medical help immediately. Local medical facilities, police and fire department numbers are indicated below:

Ambulance, Police, Fire: 911

The nearest hospitals are: Alameda County Hospital
(Highland Hospital)
1411 East 31st Street
Oakland, California
(415) 534-8055

Oakland Hospital
2648 East 14th Street
Oakland, California
(415) 532-3300

Telephone communication will be available on-site via cellular car phone.

EXHIBIT A

TABLES AND FIGURES ILLUSTRATING THE OCCURRENCE OF CHEMICALS

EMBARCADERO COVE STATE SUPERFUND SITE OAKLAND, CALIFORINA

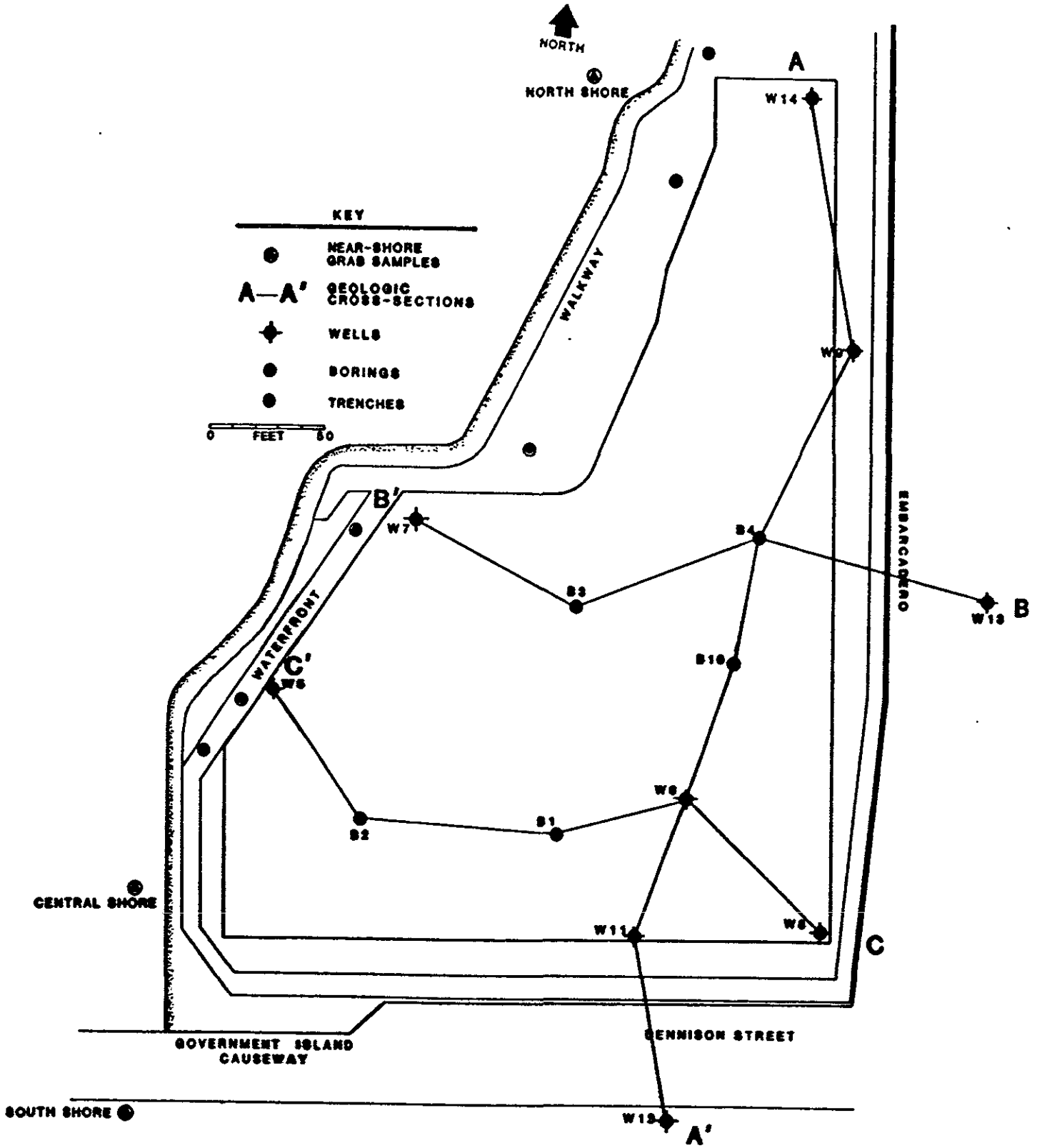


FIGURE 3-3
LOCATIONS OF WELLS, BORINGS, CROSS-SECTIONS, AND TRENCHES AT EMBARCADERO COVE.

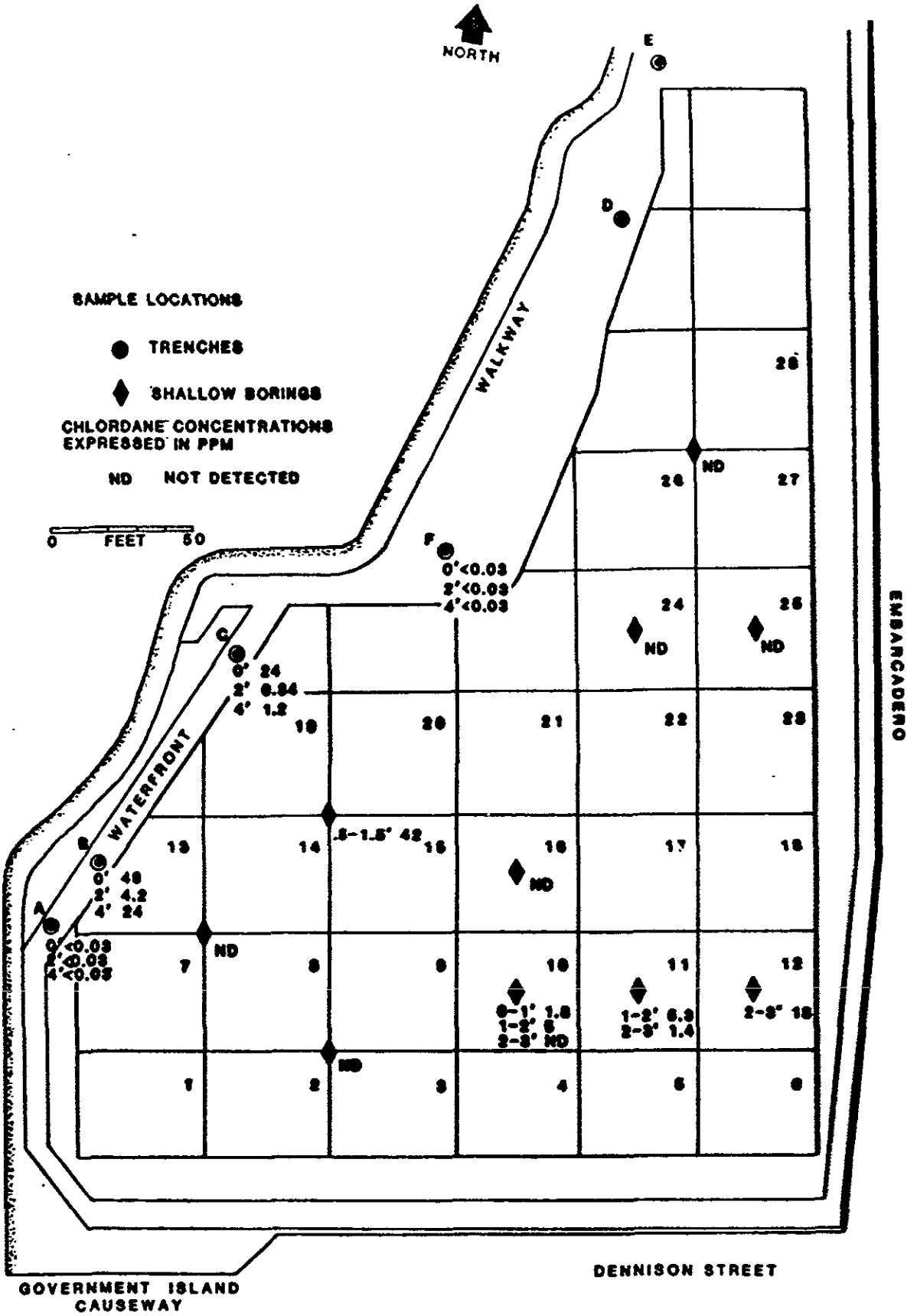


FIGURE 3-7. PESTICIDE (CHLORDANE) LEVELS IN SOIL

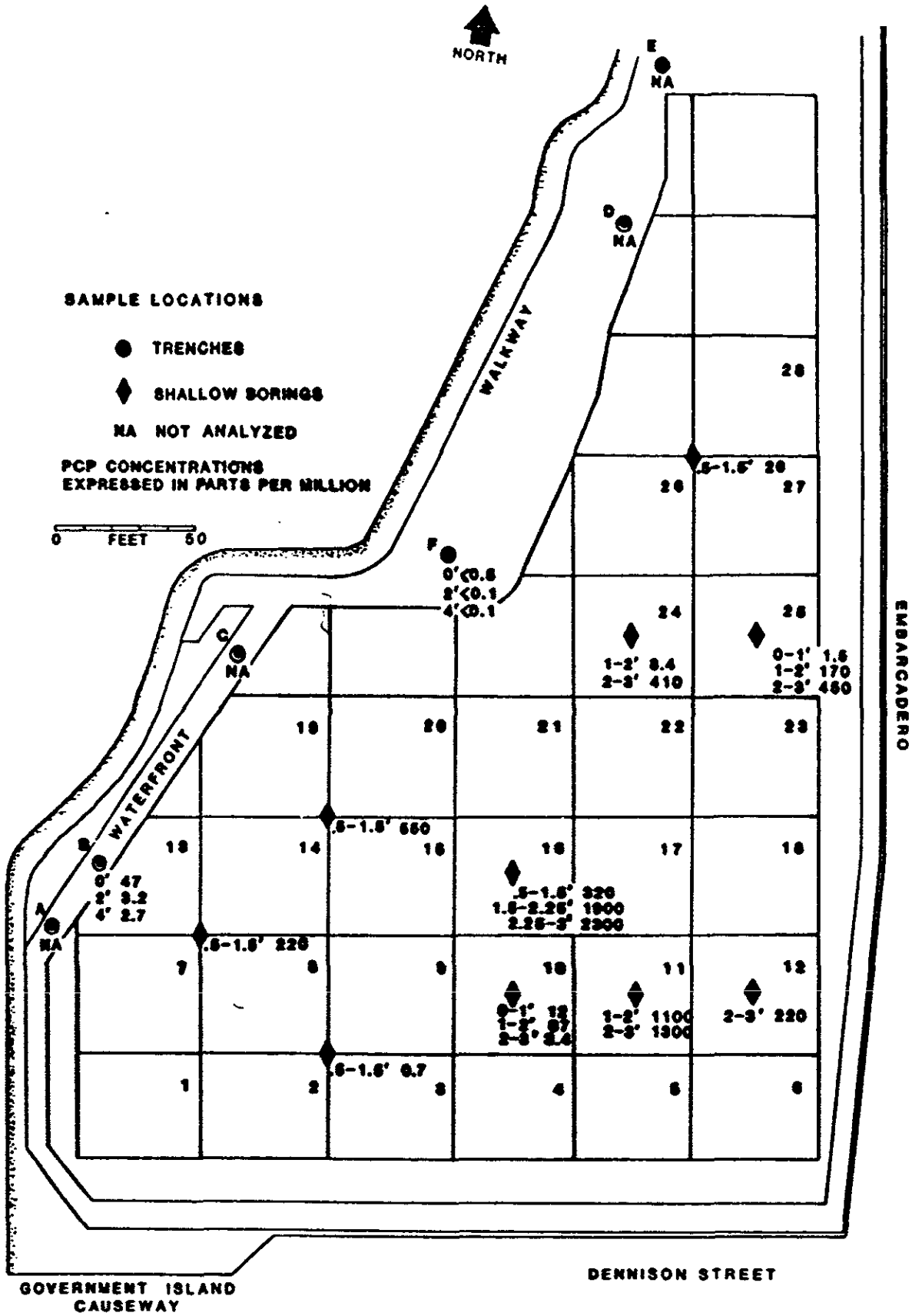


FIGURE 3-8. PCP CONCENTRATIONS IN SOIL

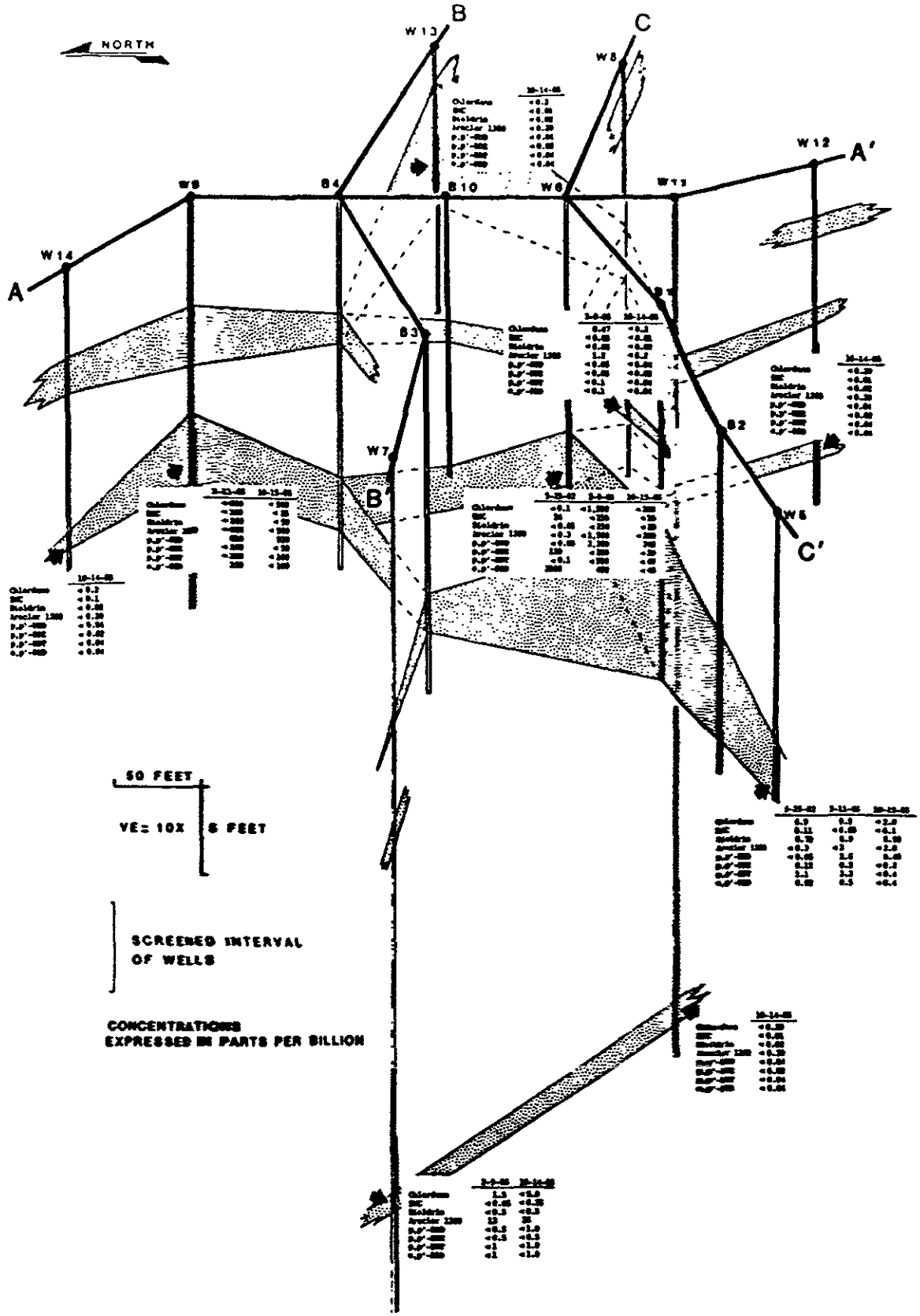


FIGURE 3-9. PESTICIDE CONCENTRATIONS IN GROUNDWATER.

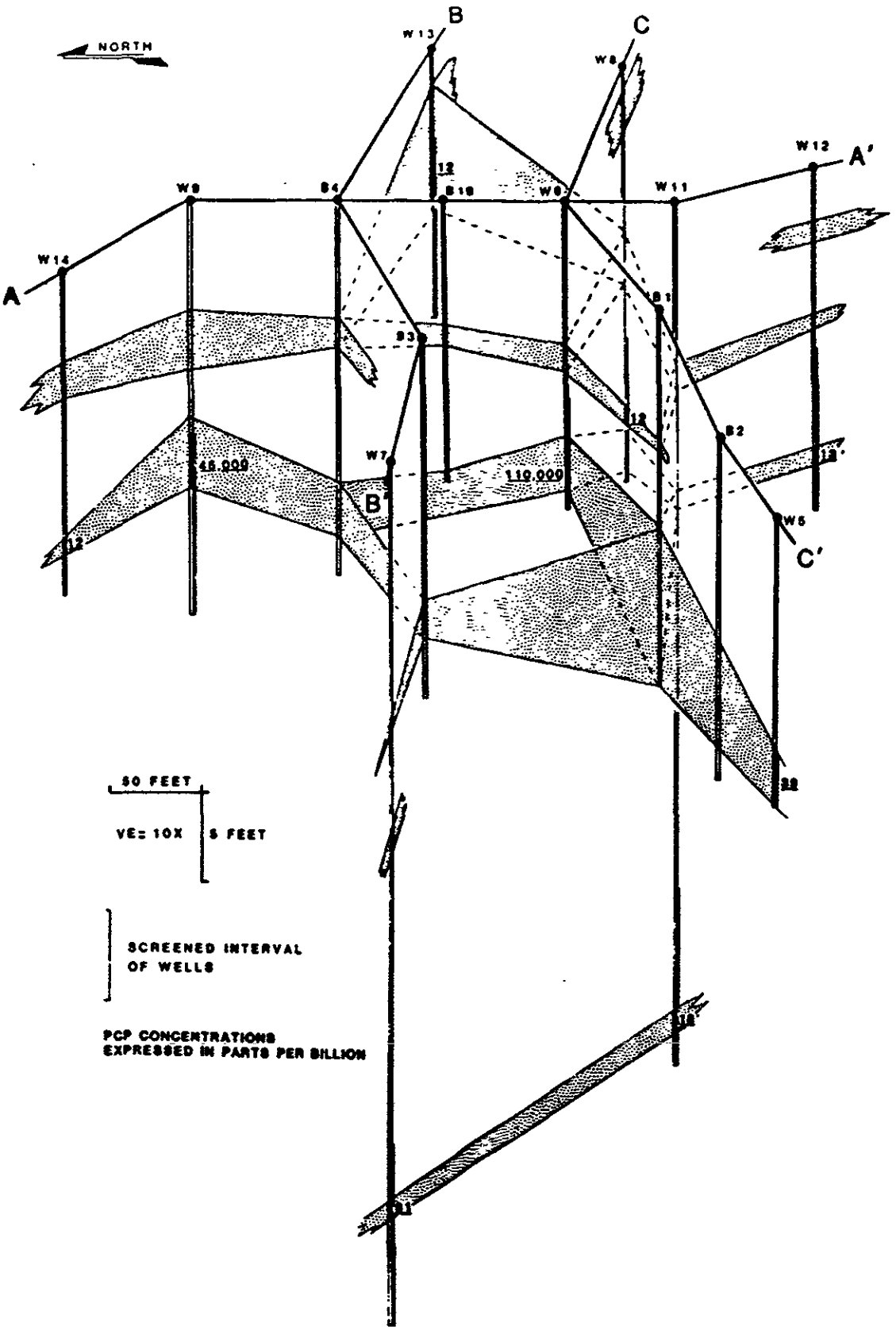


FIGURE 3-10. PCP CONCENTRATIONS IN GROUNDWATER.

Table 3-3
Results of Analyses of Soil Samples for Organic Compounds

Location	Concentration, mg/kg											
	PCP	Total PCB	Aldrin	BHC	Chlordane	Dieldrin	DDT	DDD	DDE	Heptachlor	Total Dioxin	Total Furans
Site A												
Surface	NA	NA	<0.01	0.87	<0.03	11	88	130	18	<0.01	NA	NA
2' depth	NA	NA	<0.01	<0.01	<0.03	0.04	1.0	0.4	<0.01	<0.01	NA	NA
4' depth	NA	NA	<0.01	0.04	<0.03	<0.01	1.7	1.09	<0.01	<0.01	NA	NA
composite	NA	NA	<0.01	<0.01	<0.03	7.0	75	11	59	<0.01	NA	NA
Site B												
Surface	47	NA	<0.01	1.1	46	11	64	6.8	<0.01	<0.01	NA	NA
2' depth	3.2	NA	<0.01	0.10	4.2	3.5	0.03	1.0	<0.01	<0.01	NA	NA
4' depth	2.7	NA	<0.01	0.32	24	3.3	0.83	39.4	<0.01	<0.01	NA	NA
composite	45	NA	<0.01	<0.01	46	12	7	<0.01	42	<0.01	NA	NA
Site C												
Surface	NA	NA	<0.01	0.12	24	<0.01	7.6	15.4	<0.01	<0.01	NA	NA
2' depth	NA	NA	<0.01	<0.01	0.34	<0.01	<0.03	<0.01	<0.01	<0.01	NA	NA
4' depth	NA	NA	<0.01	<0.01	1.2	<0.01	<0.03	<0.01	<0.01	<0.01	NA	NA
composite	NA	NA	<0.01	<0.01	5	<0.01	18	<0.01	27	<0.01	NA	NA
Site F												
Surface	<0.5	NA	<0.01	1.8	<0.03	<0.01	6.2	378	2.8	<0.01	NA	NA
2' depth	<0.01	NA	<0.01	<0.01	<0.03	<0.01	<0.03	7.8	<0.01	<0.01	NA	NA
4' depth	<0.01	NA	<0.01	<0.01	<0.03	<0.01	<0.03	<0.01	<0.01	<0.01	NA	NA
Dirt Pile	130	<1.0	0.39	0.83	17	45	65	16.6	0.2	0.68	NA	NA
EBMUD Trench	0.78	<0.25	<0.05	<0.05	0.71	0.09	2.14	0.61	<0.05	<0.05	NA	NA

Table 3-3
Results of Analyses of Soil Samples for Organic Compounds

Location	Concentration, mg/kg											
	PCP	Total PCB	Aldrin	BHC	Chlor-dane	Dieldrin	DDT	DDD	DDE	Hepta-chlor	Total Dioxin	Total Furans
Grid 10												
0-1 ft.	12	NA	0.1	<0.1	1.8	<0.5	<20	<30	<0.05	<0.5	NA	NA
1-2 ft.	67	NA	<0.05	<0.05	5.0	<0.5	<2.0	<0.5	<0.05	<0.5	NA	NA
2-3 ft.	3.4	NA	<0.05	<0.05	<0.5	<0.1	<0.3	<0.1	0.1	<0.1	NA	NA
Grid 11												
1-2 ft.	1100	NA	<0.1	<0.1	5.3	<0.5	<2	<2	<0.5	<0.5	NA	NA
2-3 ft.	1300	NA	<0.1	<0.1	1.4	<0.5	<2	<5	<0.5	<0.5	NA	NA
Grid 12	220	NA	<0.2	<0.2	18	<1	<4	<4	<1	<1	NA	NA
Grid 16												
0.5-1.5 ft.	320	NA	<0.1	<0.1	<1	<0.5	<1.5	<0.5	<0.5	<0.5	NA	NA
1.5-2.5 ft.	1900	NA	<0.1	<0.1	<1	<0.5	<1.5	<0.5	<0.5	<0.5	NA	NA
2.25-3.0 ft.	2300	NA	<0.1	<0.1	<1.0	<0.5	<2	<5	<0.5	<0.5	NA	NA
Grid 24												
1-2 ft.	8.4	NA	<0.05	<0.05	<0.05	<0.01	<0.3	<0.1	<0.1	<0.1	NA	NA
2-3 ft.	4.0	NA	<0.05	<0.05	<0.05	<0.1	<0.3	<0.1	<0.1	<0.1	NA	NA
Grid 25												
0-1 ft.	1.5	NA	<0.05	<0.05	<0.05	<0.01	<0.3	<0.1	<0.1	<0.1	NA	NA
1-2 ft.	170	NA	<0.05	<0.05	<0.05	<0.01	<0.3	<0.1	<0.1	<0.1	NA	NA
2-3 ft.	450	NA	<0.05	<0.05	<0.05	<0.01	<0.3	<0.1	<0.1	<0.1	NA	NA

Table 3-3
Results of Analyses of Soil Samples for Organic Compounds

Location	Concentration, mg/kg											
	PCP	Total PCB	Aldrin	BHC	Chlordane	Dieldrin	DDT	DDD	DDE	Heptachlor	Total Dioxin	Total Furans
Grid Intersections												
2,3,8,9	0.7	NA	<0.05	<0.05	<0.5	<0.1	<0.3	<0.1	<0.1	<0.1	NA	NA
7,8,13,14	220	NA	<0.05	<0.05	<0.5	<0.1	<0.3	<0.1	<0.1	<0.1	NA	NA
14,15,19,20	550	NA	<0.2	<0.2	42	<1	<6	<8	<1	<1	NA	NA
26,27,28	26	NA	<0.05	<0.05	<0.5	<0.1	<0.3	<0.1	<0.1	<0.1	NA	NA

Notes: PCP = Pentachlorophenol
BHC = Lindane

TABLE 3-4
RESULTS OF PRIORITY POLLUTANT METALS
ANALYSES OF SOILS

CONSTITUENT	CONCENTRATION, MG/KG								
BORING:	10	10	10	10*	10*	10*	10*	10*	10*
DEPTH:	4-5'	7.5-8.5'	12-13'	0-1'	6-7'	10-11'	11-12'	13-14'	14-15'
Antimony	<2	<2	<2	NA	NA	NA	NA	NA	NA
Arsenic	14	13	<2	0.017	0.046	0.054	0.32	0.16	0.058
Barium	210	160	240	10	13	7.3	6.0	5.3	6.7
Beryllium	1.1	1.1	0.9	NA	NA	NA	NA	NA	NA
Cadmium	<0.2	<0.2	<0.2	NA	NA	NA	NA	NA	NA
Chromium	36	38	14	0.16	0.16	0.24	0.47	0.40	0.34
Cobalt	17	18	6.9	NA	NA	NA	NA	NA	NA
Copper	23	25	14	0.18	0.11	0.11	0.32	0.02	0.08
Lead	17	17	8	0.4	0.4	0.4	1.3	0.8	0.7
Molybdenum	<2	<2	<2	NA	NA	NA	NA	NA	NA
Nickel	85	120	61	1.9	0.88	1.1	1.7	1.3	0.96
Selenium	<2	<2	<2	NA	NA	NA	NA	NA	NA
Silver	0.6	0.6	<0.1	NA	NA	NA	NA	NA	NA
Mercury	0.52	0.72	0.12	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium	11	11	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	75	57	3	<0.2	<0.2	<0.2	0.7	0.5	<0.3
Zinc	75	75	46	0.28	<0.06	0.12	1.3	0.94	0.55

TABLE 3-4 (continued)

CONSTITUENT	CONCENTRATION, MG/KG						
GRID:	10	11	12	16	16	24	25
DEPTH:	0-1'	1-2'	2-3'	0.5-1.5'	1.5-2.2'	1-2'	0-1'
Antimony	<2	<2	<2	<2	<2	<2	<2
Arsenic	<2	6	<2	<2	<2	8	<2
Barium	65	220	190	160	280	210	72
Beryllium	0.7	1.0	0.9	0.8	0.9	1.0	1.0
Cadmium	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chromium	16	74	49	26	25	33	34
Cobalt	7.1	18	15	11	16	17	21
Copper	16	35	24	20	18	21	16
Lead	9	73	41	14	10	22	13
Molybdenum	<2	<2	<2	<2	<2	<2	<2
Nickel	38	110	71	65	77	77	98
Selenium	<2	<2	<2	<2	<2	<2	<2
Silver	0.3	0.7	0.8	0.4	0.4	0.6	0.2
Mercury	0.6	0.77	0.25	0.10	0.27	0.27	0.27
Titanium	6	10	11	8	9	10	8
Vanadium	16	43	35	30	29	42	35
Zinc	300	310	120	450	63	120	240

TABLE 3-4 (continued)

CONSTITUENT	CONCENTRATION, MG/KG			
INTERSECTION OF GRIDS:	2,3,8,9	7,8,13,14	14,15,19,20	26,27,28
Antimony	<2	<2	<2	<2
Arsenic	11	8	18	<2
Barium	170	400	310	170
Beryllium	1.2	1.1	1.3	1.0
Cadmium	<0.2	<0.2	<0.2	<0.2
Chromium	37	36	49	33
Cobalt	17	15	19	18
Copper	35	24	35	17
Lead	19	21	19	15
Molybdenum	<2	<2	<2	<2
Nickel	87	81	120	98
Selenium	<2	<2	<2	<2
Silver	0.5	0.7	0.8	0.5
Mercury	0.2	0.11	0.3	0.25
Titanium	12	11	13	11
Vandium	54	41	65	48
Zinc	94	62	86	51

* Results of Waste Extraction Test

Notes: NA - not analyzed
Sampling Date: February 6, 1985

Table 3-5
Results of Analyses of Groundwater for Organic Chemicals
Through October 1985

Constituent	Concentration, micrograms/liter								
Well No.:	5			6			7		
Date:	5-25-82	2-11-85	10-15-85	5-25-82	2-9-85	10-15-85	2-9-85	4-1-85	10-14-85
Ethylbenzene	<1	<1	<0.5	200	<20	<10	<1	<1	<0.5
Toluene	2	<1	<0.5	300	730	85	<1	<1	<0.5
Acetone	88	<10	<0.5	330,000	140,000	<10	1800	<20	<0.5
Isopropanol	13	<30	<0.5	29,000	<600	<10	<30	<20	<0.5
Total Xylenes	<1	<3	<0.5	2,600	830	210	<3	<2	<0.5
Pentachlorophenol	33	51	39	380,000	70,000	110,000	170	NA	<81
Chlordane	6.9	9.5	<2.0	<0.1	<1500	<200	1.5	NA	<5.0
BHC	0.11	<0.05	<0.1	24	<250	<10	<0.05	NA	<0.25
Dieldrin	0.73	0.9	0.98	<0.05	<250	<20	<0.5	NA	<0.5
PCB (Aroclor 1260)	<0.3	<3	<2.0	<0.3	<1500	<200	13	NA	26
p,p'-DDD	<0.05	2.6	0.45	<0.05	2300	240	<0.5	NA	<1.0
p,p'-DDE	0.12	0.2	<0.2	120	<250	<20	<0.5	NA	<0.5
p,p'-DDT	1.1	3.2	<0.4	<0.1	<500	<40	<1	NA	<1.0
o,p'-DDD	0.92	0.5	<0.4	2500	490	<40	<1	NA	<1.0

Table 3-5 (continued)
Results of Analyses of Groundwater for Organic Chemicals
Through October 1985

Constituent	Concentration, micrograms/liter							
Well No.:	8		9		11	12	13	14
Date:	2-8-85	10-14-85	2-11-85	10-15-85	10-14-85	10-14-85	10-14-85	10-14-85
Ethylbenzene	<1	<0.5	1500	<650	<0.5	<0.5	<0.5	<1.0
Toluene	<1	<0.5	860	<50	<0.5	<0.5	<0.5	<1.0
Acetone	690	<0.5	370	<50	<0.5	<0.5	<0.5	<1.0
Isopropanol	<30	<0.5	<600	<50	<0.5	<0.5	<0.5	<1.0
Total Xylenes	<3	<0.5	3200	<1500	<0.5	<0.5	<0.5	<1.0
Pentachlorophenol	25	12	35,000	45,000	18	13	12	12
Chlordane	0.47	<0.2	<600	<500	<0.20	<0.20	<0.2	<0.2
BHC	<0.05	<0.01	<100	<25	<0.01	<0.01	<0.01	<0.1
Dieldrin	<0.05	<0.02	<100	<50	<0.02	<0.02	<0.02	<0.02
PCB (Arocior 1260)	1.2	<0.2	<600	<500	<0.20	<0.20	<0.20	<0.20
p,p'-DDD	<0.05	<0.04	610	920	<0.04	<0.04	<0.04	<0.04
p,p'-DDE	<0.05	<0.02	<100	<50	<0.02	<0.02	<0.02	<0.02
p,p'-DDT	<0.1	<0.04	<200	<100	<0.04	<0.04	<0.04	<0.04
o,p'-DDD	<0.1	<0.04	150	<100	<0.04	<0.04	<0.04	<0.04

Notes: NA = Not Analyzed

Table 3-6

Results of Dioxin and Dibenzofuran Analyses
of Groundwater Samples

Constituent	Concentrations in Well Waters, ppb Well 5	Well 6	Well 9
Dibenzofurans			
tetrachloro-	ND	ND	ND
pentachloro-	ND	ND	ND
hexachloro-	ND	281	950
heptachloro-	ND	2660	10,700
octachloro-	ND	3970	18,600
Dibenzodioxins			
tetrachloro-	ND	ND	ND
pentachloro-	ND	ND	ND
hexachloro-	ND	98.5	430
heptachloro-	ND	2000	9770
octachloro-	ND	30700	41,100

Notes: ND = None Detected
Water samples collected April 4, 1986.

EXHIBIT B

ERM GROUP HEALTH AND SAFETY MANUAL

ERM GROUP

HEALTH AND SAFETY MANUAL

October 1985

TABLE OF CONTENTS

This policy manual consists of two basic elements:

- Mandatory requirements including the responsibilities outlined in Sections 2, 3, 6, 7, and 8.

- General guidelines for minimizing exposure to hazardous conditions and materials; Sections 4, 5, 6, and 7.

SECTION 1

INTRODUCTION

The nature of our work, current regulatory status, and ERM's concern for the health and safety of its personnel all require that the ERM Group implement a health and safety program. The purpose of this program is first and foremost to protect the health and welfare of company personnel during the conduct of field investigations.

All ERM Group employees involved in field investigations will be required to participate in the ERM Group Health and Safety Program as a condition of employment. Unwillingness to participate in the Health and Safety Program may be a cause for termination or disciplinary action. For the purpose of this program, an ERM Group employee is henceforth defined as any technical person who is involved in the conduct of field investigations. This includes individuals who may only be required to participate in field investigations on a very limited basis (e.g., once or twice a year). A field investigation is defined as any investigation which requires visiting a site, regardless of the work to be conducted or the nature of the site.

The ERM Group Health and Safety Program consists of three integral parts: a Health and Safety Manual, medical monitoring, and training. This document, in addition to being a statement of company policy, also constitutes the ERM Group Health and Safety Manual and, as such, must be read by all employees prior to conducting any field investigation and thereafter periodically reviewed.

There is, however, a major shortcoming with any health and safety manual. It is impossible to prepare a manual which will account for all levels of activity and all possible situations and account for all site-specific conditions which could affect an individual site health and safety program. Therefore, it is mandatory that each employee involved in field investigations participate fully in the ERM Group Health and Safety Program and rely upon the designated levels of responsibility for guidance in health and safety matters. Prior to each field investigation, a site-specific health and safety plan must be prepared, as discussed in Section 6.

SECTION 2

ERM SAFETY ORGANIZATION AND RESPONSIBILITIES

Every employee has the ultimate responsibility for insuring that necessary health and safety procedures are properly performed. However, there are certain personnel within the ERM Group who have specific designated responsibilities. Each ERM Group office designates an individual to serve as the Office Health and Safety Coordinator. At a minimum, the Health and Safety Coordinator must have an appropriate level of safety training and experience in work at hazardous waste sites. Questions concerning the type of training and experience required can be addressed to the ERM, Inc. Health and Safety Coordinator.

The ERM Group Health and Safety Coordinators' responsibilities will include the following:

- working with project geologists/engineers or project managers to prepare site-specific health and safety plans,
- insuring that all employees are aware of the guidelines and requirements set forth in this manual,
- conducting in-house training in the use of the safety equipment and protective clothing, and
- insuring that a complete inventory of personnel protective clothing and monitoring equipment are available to field personnel.

In addition to the Health and Safety Coordinators, each investigation must have a designated Project Health and Safety Officer (i.e., Project Manager or other designated person) whose responsibility it is to oversee compliance with the site-specific health and safety plan.

COMPONENTS OF
ERM HEALTH AND SAFETY PROGRAM

Health and Safety Manual and Videotape - Introduces ERM employees to general health and safety protocols and ERM health and safety policy and procedures.

Medical Monitoring Program - Baseline and periodic medical examinations performed to determine employee's ability to use personal protective equipment and identify job-related deviations in an employee's health.

Repiratory Protection Program - Provides routine inspection and maintenance of employee's respiratory protective equipment; ensures employee's respiratory protective equipment is functioning at optimum efficiency through fit testing and proper selection.

"Right-to-Know" Program - Informs employees of hazards in the workplace and appropriate safety precautions to follow as required by Pennsylvania Department of Labor.

Instrument Operation Training - Instructs employees on proper use and care of monitoring instruments to ensure instrument reliability and operation, as well as proper data interpretation.

First Air/CPR Training - Field employees are trained in first aid as required by 29 CFR 1910.151. CPR is provided on a voluntary basis, although strongly recommended for all field personnel.

Site Safety Training/Site Health and Safety Plan - Site health and safety plan is required prior to start-up of field activities. Health and safety plan serves as training tool for reducing/ eliminating exposure to site-specific hazards. Pre-activity safety meetings ensure site personnel understand procedures to be followed during field operations.

Personnel Qualification and Experience Review - Field employee's qualifications and experience are reviewed to determine level of training an individual has received through work experience and studies/courses.

Personnel Interview and Documentation - Field personnel are interviewed to determine and document understanding of general health and safety protocols and to ensure proper training materials were received.

Introductory Training - Provided to those employees whose qualifications or experience do not meet standards necessary to safely perform field activities, as determined by qualifications and experience review.

COMPONENTS OF ERM HEALTH AND SAFETY PROGRAM (continued)

Annual Refresher Training - Minimum of eight hours' update training provided annually to review general field health and safety protocols and to inform employees of changes, additions, etc., regarding health and safety procedures.

Supplemental Information - Pertinent information regarding health and safety is distributed to appropriate personnel. Reference material is made available for individual study.

SECTION 3

MEDICAL MONITORING AND TRAINING

3.1 Medical Monitoring

All employees involved in field work are required as a condition of their employment to participate in the medical monitoring program. The medical monitoring program is designed to determine an employee's ability to conduct various field tasks. This includes determination of an employee's ability to use various levels of protective clothing. The tests described later in this section are recognized as necessary for determining an employee's ability to perform under the various levels of protection described in Section 5.

The medical/monitoring program has three essential components:

1. Baseline medical examinations to establish an individual's state of health, baseline physiological data, and ability to wear personal protection equipment.

2. Annual physicals.

3. Whenever a situation occurs at a site which may pose a significant health risk, or personnel exhibit currently job-related physical conditions, the Health and Safety Coordinator may recommend that such individuals consult with the examining physician for examination and treatment in accordance with good medical practice.

The baseline medical examinations should include, but not be limited to, the following procedures:

1. Complete medical and occupational/environmental history and a physical examination

2. Pulmonary function tests, defined as FEV1 and FVC

3. An EKG -- 12-lead

4. A chest X-ray (PA) with interpretation by NIOSH-certified "B" reader (at the discretion of the examining physician)

5. A urinalysis -- routine and microscopic

6. Chemzyme analysis (E/G ratio), SGTP, SGOT, alumalbumin, alkaline phosphatases, bilirubin (total), BUN, creatinime ratio, calcium, CO_2 content, cholesterol, chlorites, cholinestersase, creatinine, globulin, glucose, LDH, phosphorus (inorganic), potassium, protein (total), sodium, triglycerides, uric acid, complete blood count with differential and platelet count

7. Audiometric testing

8. Visual acudity (to be performed as part of the physical examination)

9. Other special tests

The need for special testing (i.e., PCB levels, serum cholesterol, heavy metals, etc.) will be determined by the examining physician.

Annual physicals do not have to include EKG or chest X-ray unless either is recommended by the examining physician. Such examinations shall include an update rather than a complete medical history of the individual.

Following the completion of each examination, the following shall be conducted:

- The examining physician will discuss with each employee the results of their examination. In these discussions, any medical condition which warrants further evaluation or treatment, and any condition which could hinder the employee from safely and efficiently completing his/her work with relationship to wearing personal protective clothing will be discussed.

- The examining physician will notify the Health and Safety Coordinator in writing that the individual has undergone a complete medical examination. In addition, the Health and Safety Coordinater will be advised as to any medical condition that the physican feels would adversely affect the individual's ability to work under conditions requiring the use of personal protective clothing.

- The results of the examination will be entered into the employee's medical records file, along with a brief medical profile (updated as required) which will rate an employee's health with respect to work restrictions (i.e., need for corrective lenses). This rating does not exclude an employee from the field, but rather indicates specific field activities or site investigations which should be avoided.

3.2 Medical Records

Each employee is required to sign an authorization (Exhibit 1) allowing the examining physician and hospital to release the employee's medical records. All medical records will be filed with a designated office personnel manager in a separate secure file. An employee's medical records will be accessible to review and utilized only for determining suitability for project field work. All files shall be treated as confidential and kept for a period of thirty (30) years. The following will have access to employee medical records:

- The employee
- The designated Office Health and Safety Coordinator
- The principal in charge of the employee; but only when the Health and Safety Coordinator feels that an employee's ability to perform a particular type of field task is in question

3.3 Training

Training is performed to insure personnel are:

- aware of the hazardous aspects of field work;
- aware of the regulations and rules of conduct specific to on-site activities;
- knowledgeable and comfortable with safe operating procedures, work practices, and emergency actions; and

EXHIBIT 1

AUTHORIZATION FOR THE RELEASE OF
EMPLOYEE MEDICAL RECORD INFORMATION

I, , (full name of employee) hereby authorize (individual or organization holding the medical records) to release to , Health and Safety Coordinator of ERM, the results of the physical examination conducted by . I give my permission for this medical information to be used for the purposes set forth in the Environmental Resources Management, Inc. Health and Safety Plan. I have read the provisions of the manual and acknowledge ERM's right to the results of the physical examinations required therein.

Employee

Date

- confident because he/she knows what to do and how to act in emergencies, in a safe, effective manner.

An introductory training course is provided to all ERM employees according to their duties and areas of need by the Health and Safety Coordinator. The following subjects must be covered as part of this training:

a. Safety and health principles
b. Introduction to hazardous materials
c. Principles of toxicology
d. Dermal protection
e. Respiratory protection principles
f. Risk assessment and site safety
g. Monitoring instruments
h. Decontamination principles

At a minimum, this training must include up to Level B protective clothing. Any questions concerning the level of training required by employees can be addressed to the ERM, Inc. Health and Safety Coordinator.

3.4 Training and Medical Monitoring of Subcontract Personnel

Under no circumstance is ERM to assume responsibility for the training or medical monitoring of subcontract personnel. This is the responsibility of the subcontractor. For language to this effect, refer to ERM's most recent subcontract driller's contract (dated 1 October 1985).

SECTION 4

BASIC PRINCIPLES OF TOXICOLOGY

To appreciate concerns over exposure to hazardous materials, it is necessary that all employees gain an understanding of the properties and effects of these materials. The following discussion is not meant to be an exhaustive review of these topics, but rather a very basic introduction to the types of concerns most often encountered during typical field investigations.

4.1 Properties of Hazardous Materials

There is a definite relationship to the potential danger posed by a chemical material and its physical state. In general, gases are more hazardous that liquids and solids, and flammable gases ignite easily. Toxic gases present the most significant hazard as they can easily gain access to the body by inhalation. Gases in the environment are also more difficult to contain than solids and liquids but they are more easily dispersed.

Liquids, on the other hand, are more hazardous than solids, and flammable liquids ignite easily only when vaporized. Although toxic liquids are not as hazardous as gases, they can be absorbed by the skin if splashed or spilled and they can be inhaled, but only when vaporized. Liquids have the additional potential hazard of being either very hot or very cold thus causing either burning or freezing.

Solids are the least hazardous of any materials. Flammable solids ignite when the ignition temperature is reached, and toxic solids have the greatest difficulty in gaining access to the body. However, it is very important to note that the greatest hazard of explosion at a waste site is often a liquid which has crystallized.

Vapor density or specific gravity is perhaps the most important piece of information required when assessing environmental contaminants. Vapor pressure will determine the way in which a material travels through the environment, the kind of hazard it poses, and the safety precautions required to afford the proper level of protection.

If the vapor density of a gas is less than one, the material is lighter than air and will rise and dissipate in the air when confined. This material could collect at high spots such as ceilings.

If the vapor density of a gas is greater than one, the material is heavier than air and will sink. The material will linger near the ground and collect in low spots. Examples are carbon monoxide, chlorine, gasoline vapors, and trichloroethylene. These materials create the additional hazard of being able to displace oxygen, both in the environment and in the human body. Correspondingly, if a liquid or solid has a specific gravity of less than one, it will float on water. If the specific gravity is greater than one, it will sink in water.

Flammable gases and vapors or flammable liquids will ignite in air when exposed to an ignition source. Each substance has a concentration above and below which it will not burn. The minimum concentration below which a flammable gas or liquid vapor will not burn, even when exposed to an ignition source, is called the lower explosive limit (LEL). The maximum concentration above which a substance will not burn is called the upper explosive limit (UEL). Continuous monitoring with LEL meters is essential in an environment of flammable gases or liquid vapors.

Flammable liquids do not burn as a liquid; they give off vapors and only ignite when a combustion mixture in air has been obtained. A flammable liquid may not give off enough vapors at its ambient temperature to ignite. Some liquids volatilize at very low temperatures. Other liquids must be heated before a flammable concentration of vapors can be produced. A minimum temperature that a liquid must reach to produce an ignitable concentration of vapor is called the flash point. The U.S. Department of Transportation designates liquids having a flash point below 100°F as being flammable and those with a flash point at or above 100°F and below 200°F as being combustible.

A flammable solid is one that will ignite through friction or spontaneously by chemical reaction with moisture or air. The temperature at which a solid begins to burn is called the ignition or kindling temperature.

In addition to the above characteristics, there are several additional unique hazards resulting from selected hazardous materials which require discussion. Some of these, along with appropriate examples, are given below:

- Some materials form toxic products from combustion or thermal decomposition including carbon monoxide from incomplete combustion, hydrogen cyanide from acrylic plastic, hydrogen chloride from PVC plastic, hydrogen fluoride from Teflon and Freon.

- Corrosive materials such as acids, alkalis, materials that form acids or alkalis upon hydrolysis, and elemental halogens can all produce hazardous reactions when coming in contact with skin tissue. It is important to remember that a concentrated base is just as corrosive, if not more so, than a concentrated acid. Some acids such as sulfuric acid also can create hazards when not coming into contact with the skin. This can happen as a result of violent reactions with some materials such as granulated metals or metal filings.

- Many common elements will react quite violently with other chemicals or when exposed to certain physical conditions. Water, or even moisture in the air, can cause some metals to ignite. Also, the by-product of a hydrolysis reaction can be corrosive, toxic, and flammable. Adding water to certain chloride salts can also produce hydrochloric acid or hydrochloric acid vapors.

4.2 Route of Exposure

The toxicity of a particular contaminant will depend upon its route of exposure into the human body. A material may be more or less toxic by a given route, depending on the modification of the chemical, if any, through biotransformation. With regard to exposure to hazardous chemicals, the two principal routes of entry are the lungs (inhalation) and skin contact.

The respiratory tract is the only organ system with vital functional elements in constant, direct contact with the environment. The lungs also have the largest exposed surface area of any organ. This surface area is between 70 and 100 square meters versus two meters for the skin and ten meters for the digestive system. The lungs are exposed by inhalation and by exhalation of chemicals absorbed through other routes such as ingestion and skin. Not only can various chemicals affect the respiratory tract, but the tract is also a route for chemicals to reach other organs. Solvents and other compounds containing lead or mercury can be absorbed through the respiratory tract and affect other

organs. The primary danger to humans as a result of inhalation of gases or other agents are damage to the respiratory system and the transport of toxics via the blood to various tissues and organs. Inhalation of toxics absorbed to dust can result in ingestion of chemicals not typically available in the vapor phase.

In terms of weight, the skin is the largest single organ of the body. It provides a barrier between the environment and other organs and, therefore, is a defense against many chemical exposures.

4.3 Toxic Effects

It is difficult to determine for any particular individual exactly what the toxic effects of a particular material would be via a particular exposure route. Sex, age, and physical condition will all affect the toxicity of a particular material on an individual. In addition, some combinations of chemicals produce different effects than those attributed to each individual. These can be grouped into three categories, including:

- Synergists: chemicals that, when combined, cause a greater than additive effect
- Potentiator: a type of synergism where the potentiator is a chemical not usually considered to be toxic but rather acts to increase the toxicity of other chemicals
- Antagonist: chemicals that, when combined, lessen the predicted effect

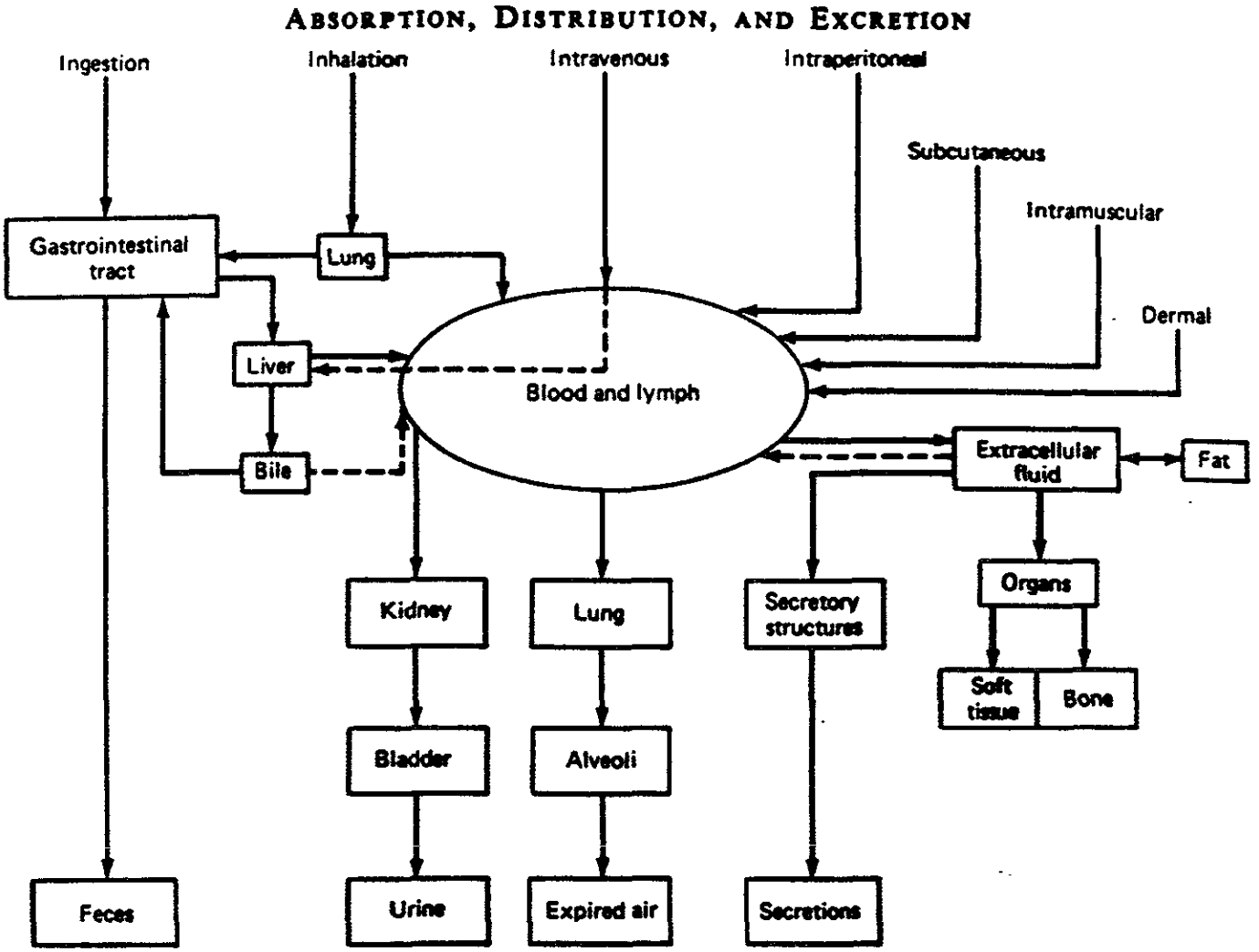
Another factor which makes it particularly difficult to determine the potential effect of a hazardous material on a human is the procedure used for determining the toxicity of the materials. Animals are used as models to study the mechanisms and the magnitude of toxicity. Therefore, the proper selection of test animals requires knowing which species most closely resemble humans with respect to the chemical of interest. However, selecting the right animal requires knowledge of the fate of the chemicals in humans as well as its fate in various animals. This factor, creates a "Catch 22" for determining the toxic effects of chemicals on humans.

4.4 Determination of Exposure Limits

The most comprehensive source of information and data on the toxicity of chemical constituents is the "Threshold Limit Values for Chemical Substances and Physical Agents in the Work Room Environment with Intended Changes" by the American Conference of Governmental Industrial Hygienists. This booklet is issued every year with revisions. The booklet gives threshold limit values (TLVs) based on time-weighted average concentrations (TWA) for an eight-hour work day, or forty-hour week, and short-term exposure limits (STEL) for excursions above TWA. The booklet also contains TLVs for carcinogens, nuisance dusts, and other physical agents.

The average chemical concentration most workers can be exposed to during a forty-hour week or an eight-hour day without adverse effect, chronic or acute, is designated as the TWA-TLV. TLVs are given in parts per million (ppm) and/or milligrams per cubic meter (mg/cm). In many cases, substances may be listed in the TLV booklet with the special designation "skin". This is to draw attention to another effect of the substance that may be as harmful as inhaling the vapor. Direct skin contact with the substance should be avoided when this designation is noted.

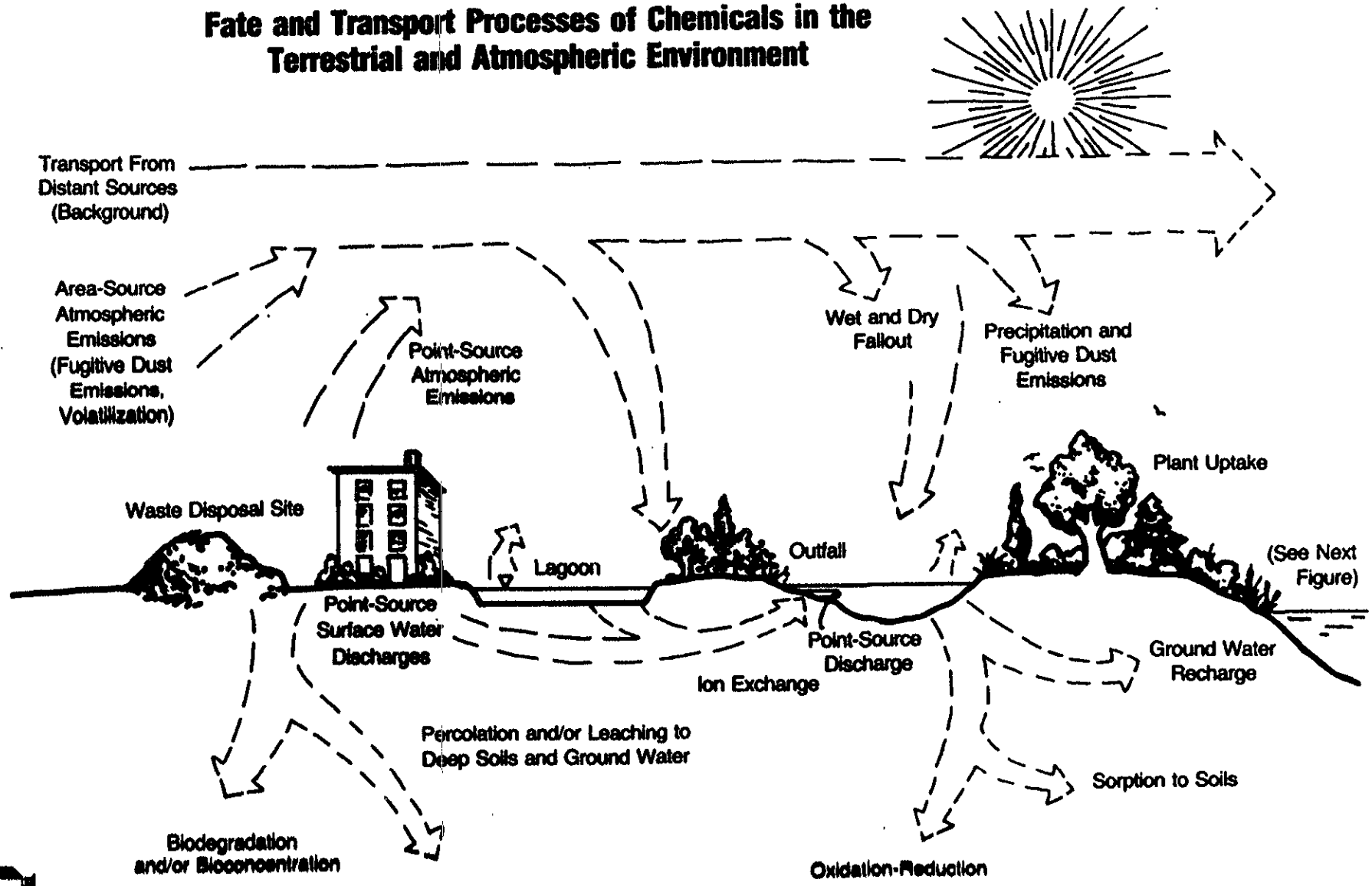
A difficulty that arises from dealing with environmental contaminants is that rarely do we find a situation where only one component or a very specific suite of identified components exist in the vapor phase. This factor, plus the possibility of synergistic or antagonistic effects requires that ERM adopt the policy of using the chemical constituent with the lowest TLV for determining required levels of action.



Routes of absorption, distribution, and excretion of toxicants in the body. (Courtesy of L. J. Casarett.)

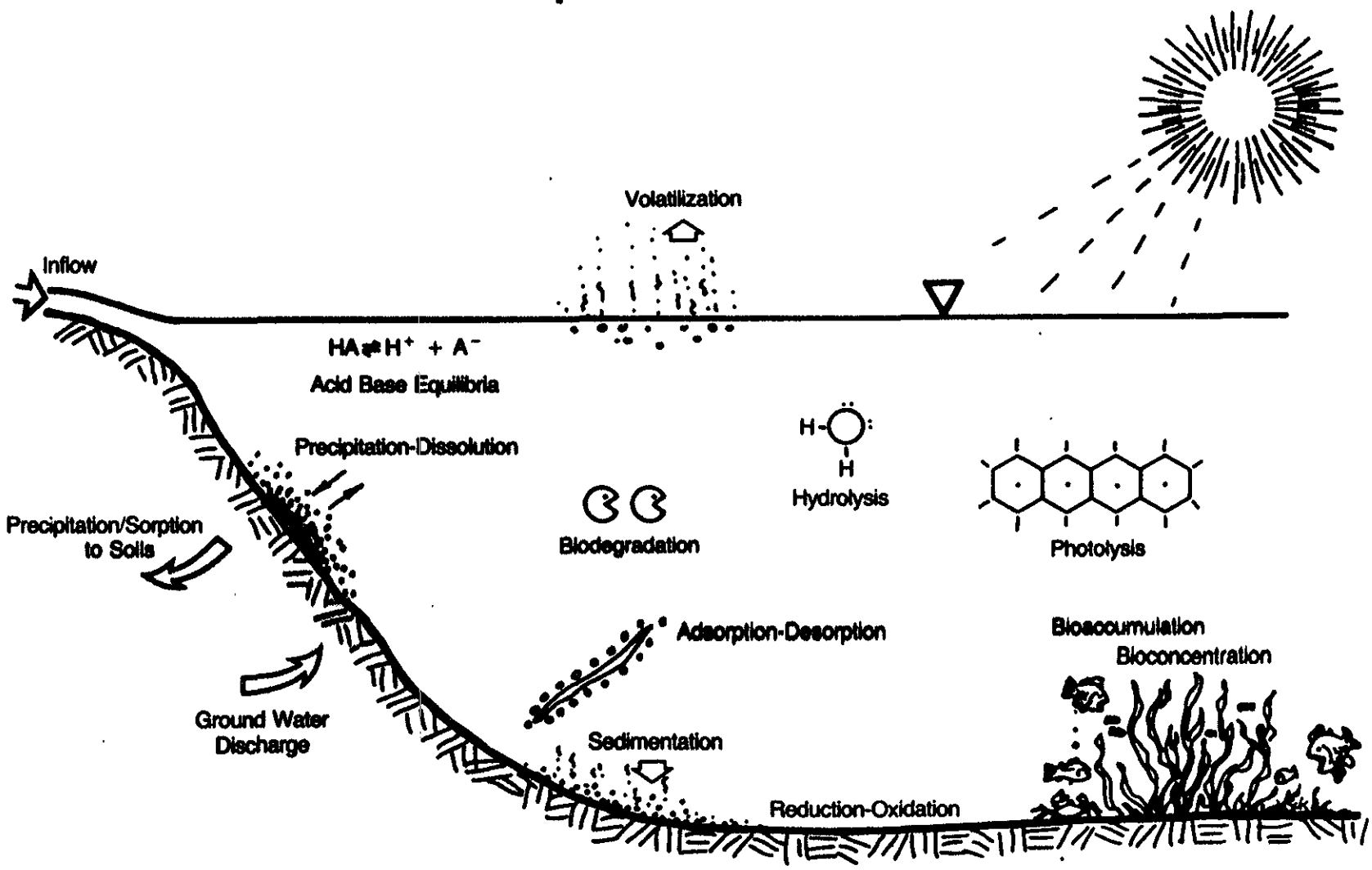
EA1

Fate and Transport Processes of Chemicals in the Terrestrial and Atmospheric Environment



EA2

Fate and Transport Processes of Chemicals in the Aquatic Environment



TOXICOLOGY GLOSSARY OF TERMS

Acute - Occurring over a short period of time (days at most); used to describe brief exposures and effects which appear promptly after exposure.

ADI - Acceptable Daily Intake represents the level of daily intake that is believed to result in no health hazard.

Chronic - Occurring over a long period of time, either continuously or intermittently; used to describe ongoing exposures and effects that develop only after a long exposure. (Chronic exposure refers to six months to a lifetime of exposure. Subchronic usually refers to a period of fourteen to ninety days in animal studies.)

LC_{50} - The concentration of a chemical in air or water which is expected to cause death in fifty percent of test animals living in that air or water. (It is important to specify the time or duration of exposure. For example, LC_{50} (96 hours) is not the same as LC_{50} (10 minutes).)

LD_{50} - The dosage of a chemical that will produce death in fifty percent of the treated animals (species, route, and duration should be specified).

LOAEL - Lowest-Observable-Adverse-Effect Level. The lowest dose used in a study which produced a measurable or observable adverse effect.

MCL - Maximum Contaminant Level. A regulated criteria for chemicals in public drinking water supplies.

NOAEL - No Observable Adverse-Effect Level. An exposure level at which there are no statistically significant increases in frequency or severity of adverse effects between the exposed population and the appropriate control. Effects may be produced at this level, but they are not considered to be adverse. NOAELs provide the basis for deriving acceptable intake levels.

PEL - Permissible Exposure Limit. The OSHA standard for workplace exposures to airborne substances (TLVs and PELs are often the same but, in many cases, TLVs are more stringent. TLVs are guidelines; PELs are regulations).

Potentiation - The ability of one chemical to magnify the effects of another chemical.

TOXICOLOGY GLOSSARY OF TERMS (continued)

REL - Recommended Exposure Limit. Established by National Institute of Occupational Safety and Health (NIOSH). Similar to TLVs and PELs.

Standard Man - Weighs 70 kg (154 pounds), breathes $20m^3$ of air per day ($10m^3$ at work), drinks 2 L of water per day, eats 0.5 kg of food per day, and is everywhere.

Synergism - An interaction of two or more chemicals that results in an effect that is greater than the sum of their independent effects.

Threshold - The lowest dose of a chemical at which a specified measurable effect is observed and below which it is not observed.

TLV - Threshold Limit Value. Refers to airborne concentrations of substances and represents conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect. TLVs are used in the practice of industrial hygiene as guidelines or recommendations in the control of potential health hazards and for no other use.

TWA - Time-Weighted Average or the average value of a parameter that varies over time.

FEDERAL LAWS CONTROLLING TOXIC SUBSTANCE EXPOSURES

Statute	Agency	Coverage
Clean Air Act (1970, amended 1977)	EPA	Air pollutants
Federal Water Pollution Control Act (1972, amended 1977, 1978)	EPA	Water pollutants
Safe Drinking Water Act (1974, amended 1977)	EPA	Drinking water contaminants
Federal Insecticide, Fungicide and Rodenticide Act (1948, amended 1972)	EPA	Pesticides
Pesticide Residues Amendment (1954, amended 1972)	EPA	Pesticide residues in food
Marine Protection, Research and Sanctuaries Act (1972)	EPA	Ocean dumping
Resource Conversion and Recovery Act (1976)	EPA	Hazardous wastes
Toxic Substances Control Act (1976)	EPA	All chemical hazards hazards not covered by other laws
Comprehenisve Environmental Response, Compensation, and Liability Act (1981)	EPA	Hazardous substances, pollutants and contaminants
Occupational Safety and Health Act (1970)	OSHA	Workplace, exposures
Food, Drug and Cosmetic Act (1932)	FDA	Food, drugs, cosmetics
Food Additives Amendment (1958)	FDA	Food additives

Statute	Agency	Coverage
Color Additive Amendments (1960)	FDA	Color additives
New Drug Amendments (1962)	FDA	New Drugs
New Animal Drug Amendments (1968)	FDA	Animal drugs and feed additives
Medical Device Amendments	FDA	Medical devices
Egg Products Inspection Act (1970)		
Federal Hazardous Substances Act (1966)	CPSC	Toxic household products
Consumer Product Safety Act (1972)	CPSC	Dangerous consumer products
Poison Prevention Packaging Act (1970)	CPSC	Packaging of dangerous products
Lead-Based Paint Poison Prevention Act (1973, amended 1976)	CPSC	Lead paint in federally-assisted housing
Hazardous Materials Transportation Act (1970)	DOT	Transportation of hazardous materials
Ports and Waterways Safety Act (1972)	DOT-USCG	Water shipment of toxic materials
Dangerous Cargo Act (1952)	DOT-USCG	Water shipment of toxic materials
Bulk Flammable Combustible Liquids Act (1970)	DOT-USCG	Water shipment of toxic materials

STATUTORY DESCRIPTION OF THE HARM

Statute	Description of Harm and/or Objects of Protection
TSCA 4(a):	"Injury to health or the environment" OR "Significant or Substantial Human Exposure"
TSCA 4(f):	"Serious, widespread harm" to "human beings" from "cancer, gene mutations, or birth defects"
TSCA 5(b)(4)(A), 5(f), 6(a)	"Injury to health or the environment"
CWA 311(b)(2)(A)	"(imminent and substantial danger to) the public health or welfare, including, but not limited to fish, shellfish, wildlife, shorelines, and beaches."
CWA 311(b)(4)	"(harmful to) the public health or welfare... including, but not limited to, fish, shellfish, wildlife and public and private property, shorelines, and beaches."
CWA 307(a)	"Death, disease, behavioral abnormalities, cancer, mutations, physiological malfunctions, including malfunctions in reporduction, or physical deformations in any organisms or their offspring."
SDWA 1401(1) 1412(b)(1)(B)	"any adverse effect on the health of persons"
SDWA 1421	"the presence of any contaminant" "affect adversely the health of persons"
MPRSA 102(a)	"unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities"
RCRA 1004(5)	"an increase in mortality" or "in serious irreversible, or incapacitating reversible, illness." OR "(substantial hazard) to human health or the environment"
RCRA 3002,3,4	"(protect" human health and the environment"

STATUTORY DESCRIPTION OF THE HARM
(continued)

Statute	Description of Harm and/or Objects of Protection
FIFRA 3(c),3(d), 6(b)	"unreasonable adverse effects on the environment" or "any unreasonable adverse effect on the environment"
FIFRA 25(c)	"Serious injury or illness to children and adults resulting from accidental ingestion or contact."
CAA 108,111,157, 202,211,231	"endanger public health or welfare"
CAA 109	"(protect) the public health"
CAA 112	"increase in mortality or serious irreversible, or incapacitating reversible, illness."
CAA 157	"adverse effects on the stratosphere, especially ozone"
CERCLA 102	"(substantial danger to) the public health or welfare or the environment"
CERCLA 104	"death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunction (including malfunctions in reproduction) in...organisms or their offspring"
OSHA 6(b)(5)	"no...material impairment of health or functional capacity"
HMTA 104	"(unreasonable risk to) health and safety or property"
FDCA 406, 408	"(protect) the public health"
FDCA 402, 601	"injurious to health"
FDCA (409(c), 512, 706(b)	"cancer in man or animal"
PWSA 33 USC 1223	"vessel or cargo loss, or damage to life, property, the marine environment...to structures in, on, or immediately adjacent to the navigable waters or the resources within such waters"
PWSA 33 USC 1225	"damage to, or the destruction of, any bridge...(harm to) the navigable waters and the resource therein"

STATUTORY DESCRIPTION OF THE HARM
(continued)

Statute	Description of Harm and/or Objects of Protection
BFCLA 33 USC 391a	"hazards to life and property, for navigation and vessel safety, and for enhanced protection of the marine environment."
CPSA 7,8	"(unreasonable risk of) injury" defined as "death, personal injury, or serious or frequent illness."
FHSA 2(f), 3(a)	"substantial personal injury or serious illness"
FHSA 3(b), 2(q)	"(protect) the public health and safety"
PPA 3	"serious personal injury or serious illness" affecting "children"

SECTION 5

SAFETY EQUIPMENT AND PROTECTIVE CLOTHING

5.1 Field Instruments

Potentially hazardous conditions can result from explosive vapor atmospheres, oxygen-deficient atmospheres, toxic atmospheres or vapors with lethal properties, and solid materials which may come into contact with either the skin or be inhaled into the lungs by being absorbed onto fine particulate matter. There are a wide variety of portable instruments available to aid in detection of these conditions. The following subsections give a brief description of some of these types of monitoring equipment. Before start of any field investigation, all field personnel must be familiar with the operation of these meters as provided in the appropriate instrument operations manual.

5.1.1 Explosimeters

Explosive and oxygen-deficient atmospheres are unique in that they can be determined by using direct reading instruments. For explosive atmospheres, a combustible gas indicator (CGI) can be used. Since a wide variety of materials are combustible, a CGI does not express concentration directly, but rather as a percent of the lower explosive limit (LEL). In theory, a mixture will not explode unless it reaches 100 percent LEL. However, the action for limitation of work in an explosive atmosphere is ten percent LEL (NIOSH criteria). This provides a safety factor of ten and is used because many factors influence CGI readings: relative humidity, temperature, interfering substances, the physical nature of a chemical, and the oxygen level.

Explosive mixtures also tend to stratify; it is not uncommon to find pockets of combustible mixtures in an otherwise safe environment. If readings of ten percent LEL are obtained, work may be continued but continuous monitoring must be performed and care must be taken to avoid ignition sources. An effort to ventilate the atmosphere and reduce the explosion potential should also be made. A reading of twenty percent LEL is considered an immediate danger to life and health (IDLH) and personnel must be evacuated. Also, work activities cannot be performed in atmospheres where a concentration of gases or vapors exceed the upper explosive limit (UEL), which is the concentration of a gas

or vapor by volume in air above which an explosion will not occur if there is an ignition source. Although a UEL mixture will not explode, it can easily be diluted into the explosive range.

Anyone requiring the use of an explosimeter must meet with the Health and Safety Coordinator prior to the start of work to be instructed in the proper use of the meter.

5.1.2 Oxygen Meters

The oxygen meter determines the amount of oxygen in the atmosphere. Readout is typically in percent oxygen. Readings are influenced by temperature, relative humidity, altitude, and interfering chemicals. Severely oxygen-deficient atmospheres usually indicate the presence of a significant quantity of pollutants. NIOSH requires that an external air supply, usually a self-contained breathing apparatus (SCBA), be used for working in atmospheres with less than 19.5 percent oxygen.

Special attention must be paid to areas where oxygen deficiency is likely to occur. Extreme caution must be used when entering any enclosed area. This includes not only buildings or sewers, but also sumps, test pits, and trenches. Prior to entering any enclosed space, all employees must review the work to be conducted with the Health and Safety Coordinator. As for the explosimeter, anyone requiring the use of an oxygen meter must meet with the Health and Safety Coordinator prior to the start of work to be instructed in the proper use of the meter.

5.1.3 Organic Vapor Meters

Determining organic vapor concentrations is not as straightforward as determinating the explosion/oxygen deficiency hazard. Several types of instruments are available and routinely used to characterize organic vapor concentrations. These include organic vapor meters (OVM) with either a flame ionization detector (FID) or a photoionization detector (PID). Both types of meters have specific advantages and disadvantages which depend upon the needs of the particular investigation. Specific details on the operation of the instruments are given in the operations manual for each instrument. Anyone requiring the use of an OVM must meet with the Health and Safety Coordinator prior to the start of work for instruction in the proper use of the meter.

MONITORING INSTRUMENTS TYPICALLY USED DURING FIELD OPERATIONS

Instrument	Hazard Monitored	Application
Combustible Gas Indicator (CGI)	Combustible gases and vapors.	Measures the concentration of a combustible gas or vapor.
Flame Ionization Detector (FID) with Gas Chromatography Option	Many organic gases and vapors.	In survey mode, detects the total concentrations of many organic gases and vapors. In gas chromatography (GC) mode, identifies and measures specific compounds. In survey mode, all the organic compounds are ionized and detected at the same time. In GC mode, volatile species are separated.
Gamma Radiation Survey Instrument	Gamma radiation.	Environmental radiation monitor.
Portable Infrared (IR) Spectrophotometer	Many gases and vapors.	Measures concentration of many gases and vapors in air. Designed to quantify one- or two-component mixtures.
Ultraviolet (UV) Photoionization	Many organic and some inorganic gases and vapors.	Detects total concentration of many organic and some inorganic gases and vapors. Some identification of compounds is possible if more than one probe is used.
Direct-Reading Colorimetric Indicator Tube	Specific gases and vapors.	Measures concentration of specific gases and vapors.
Oxygen Meter	Oxygen	Measures the percentage of oxygen in air.

5.2 Respiratory Protection

After it has been determined that the atmospheric condition is hazardous, it becomes necessary to protect the worker by one of the following techniques:

- evacuation from the area of concern
- use engineering controls such as ventilation to eliminate the hazard
- use a respirator to either purify the air or to supply air

According to OSHA regulations (29 CFR 1910.134), employees must be supplied with suitable respiratory protection equipment and a respiratory protection program that includes the following:

- standard operating procedures for selection and use of respirators,
- proper selection of respirators on the basis of hazard,
- training of personnel on use and limitations,
- regular cleaning and maintenance,
- proper storage,
- routine monthly inspections and inspections before and after use,
- constant monitoring of work area for adverse conditions and worker stress,
- continual evaluation of a respiratory compliance program once in operation,
- determination of medical fitness of potential user, and
- use of only approved equipment and only after proper fit testing has been performed.

There are several physiological/psychological problems which may preclude an individual from wearing respiratory equipment, including:

- Pulmonary problems
- Cardiovascular problems
- Skin sensitivity, diabetes, perforated ear drum
- Claustrophobia, anxiety, discomfort

Most of the above items could be detected during the medical monitoring program. Persons not physically capable of using an air-purifying respirator or pressure-demand air source will not be allowed to work in situations which may require their use. Furthermore, if an individual possesses a physiological/psychological problem (not detected during the medical monitoring program but known to the individual) which would restrict their use of respiratory equipment, they should consider the effects this may have not only on themselves, but also their co-workers and notify either their Principal-in-Charge or the Health and Safety Coordinator of these problems. Any information supplied in this manner will be kept strictly confidential.

The selection of an appropriate respirator for a particular site condition is a difficult procedure. For this reason, no employee will be allowed to use an air-purifying respirator or air-demand system without first being fully trained and having consulted the Health and Safety Coordinator regarding the proper equipment to be employed. Training for use of an air-purifying respirator will be conducted by the Health and Safety Coordinator. Training for the use of an air-supplied respirator must be through a recognized health and safety organization. Guidance in selection of a qualified health and safety organization can be obtained from the ERM, Inc. Health and Safety Coordinator. The selection of the proper respirator is more difficult than simply determining the TLV of the contaminants on a particular site. Additional criteria such as the absorbent nature of the contaminants, the potential for eye irritation of the contaminants, the efficiency of the cartridge for a particular contaminant, and its potential breakthrough time must all be considered.

The following basic facts are important for the use of air-purifying respirators (canisters or cartridge type):

- Air-purifying respirators employ filtering of air by the use of mechanical filters and/or absorbents and, therefore, have a limited lifetime.

- They must not be used in atmospheres that are oxygen deficient (less than 19.5 percent oxygen).

- They must not be used in atmospheres that are immediately dangerous to life and health (IDLH).

- Monitoring of the atmosphere must be performed while an air-purifying respirator is being used.

- A minimum of two people must be on site when the use of air-purifying or air-supplied respirators is required.

There are generally two types of respiratory protection. These include the air-purifying respirator and supplied air or self-contained breathing apparatus. Due to the nature of ERM's work, it is envisioned that the majority of our work will be conducted either with no respiratory protection or with air-purifying respirators. No one will be permitted to work under conditions requiring supplied air respirators unless they have been properly trained. The following policy will be adhered to in the fitting and use of respirators:

- The person must have passed a fit test.

- If it is found that a person cannot obtain a good respirator to face seal because of facial characteristics, that person will not be allowed to enter an atmosphere that requires respiratory protection.

- Facial hair such as beards, sideburns, and certain mustaches which may interfere with the fit test are not allowed.

- Persons requiring corrective lenses shall be provided with specially mounted lenses inside the full-face mask. Under no circumstances will contact lenses or glasses be worn while using respiratory protection.

- A person may only use the specific type and model of full-face air-purifying respirator for which the person has obtained a satisfactory fit via the qualitative fit testing procedure.

5.3 Personal Protective Clothing

Personal protective equipment can provide a barrier between the person and a hazardous environment thus preventing harmful effects due to skin contact. The proper selection of equipment is important in preventing exposures. The level of protection, type and kind of equipment selected depends on the hazardous conditions and, in some cases, availability, compatibility with

other equipment, and performance. Protective materials are made of several different materials for protection against specific types of chemicals. There is no universal protective material. All will decompose, be permeated by, or otherwise fail to protect under a given circumstance. Most manufacturers have guides on product durability. Unfortunately, these guides usually rate degradation and not permeation and therefore can be misleading.

During most site work, chemicals are usually in mixed combinations and the protective material is not in continuous contact for long periods of time. Therefore, the selected material may not be the best protecting material for long exposures but adequate for short periods of time. Selection should depend upon the most hazardous chemical based on skin hazard and concentration. Sometimes wearing several layers of protective clothing constructed of different types of materials affords the best protection.

Prior to conducting any field investigation, the Health and Safety Coordinator will determine the levels and types of protective clothing to be used. The Health and Safety Coordinator's decision will be based on the following factors:

- Concentration of the chemical(s)
- Physical state of the material(s)
- Length of exposure to the material(s)
- Type of work to be conducted with respect to the material's ability to resist abrasion and dexterity required to complete the work
- Ability to decontaminate
- Climatic conditions during the work period
- The amount of work to be conducted

An overall protective clothing scheme providing various levels of protection is a convenient means of selecting protective clothing and respiratory protection. Levels A, B, C, D, and E will be used to denote levels of protection. Note that these are in addition to any facility required protection (i.e., hard hats, goggles, etc.). Given below are the types of clothing and options for each level:

- Level A. Level A protection requires the use of a fully encapsulated suit and self-contained breathing apparatus. The use of Level A equipment is highly specialized and required only under extremely hazardous conditions. At this time, ERM does not foresee the need for this type of equipment in its investigations.

- Level B.

  a. pressure-demand cascade air system or other suitable self-contained, pressure-demand breathing apparatus

  b. chemical-resistant clothing; type of material and design to be determined by the Health and Safety Coordinator (option: attached hood and boots)

  c. inner surgical-type gloves

  d. outer nitrile or latex gloves

  e. leather work boots and disposable or washable outer boots

  f. options as required:

     1. steel-toed boots
     2. hard hat
     3. face shield
     4. respiratory fit prescription safety glasses if prescription glasses or contact lenses are normally worn

- Level C.

  a. full-face/half-face air-purifying respirator equipped with appropriate canisters or cartridge

  b. chemically resistant clothing; type and design to be determined by Health and Safety Coordinator (option: attached hood and boots)

  c. inner surgical-type gloves

  d. outer nitrile or latex gloves

  e. leather work boots and disposable or washable outer boots

f. options as required:

1. steel-toed boots
2. hard hat
3. respirator fitted prescription safety glasses required if prescription glasses or contact lenses are normally worn

- Level D.

a. chemically resistant clothing; type and design to be determined by the Health and Safety Coordinator

b. inner surgical-type gloves

c. outer nitrile or latex gloves

d. leather work shoes and disposable or washable outer boots

e. options as required:

1. steel-toed boots
2. hard hats
3. dust masks
4. safety goggles/face shield

- Level E.

a. coveralls or pants and, at a minimum, short-sleeved shirts (under no circumstances will shorts, muscle shirts, or going without a shirt be permitted during any type of field investigation)

b. leather work boots (no sneakers)

c. nitrile or latex gloves (required when sample handling)

d. options as required:

1. disposable outer boots
2. hard hats
3. safety glasses, goggles, or face shield
4. steel-toed boots

DESCRIPTION OF PROTECTION LEVELS

	Equipment	Protection Provided	Should Be Used When:	Limiting Criteria
Level A	RECOMMENDED: • Pressure-demand, full facepiece SCBA or pressure-demand supplied-air respirator with escape SCBA. • Full-encapsulating, chemical-resistant suit. • Inner chemical-resistant gloves. • Chemical-resistant safety boots/shoes. • Two-way radio communications. OPTIONAL: • Cooling unit • Coverall • Long cotton underwear • Hard hat • Disposable gloves and boot covers	The highest available level of respiratory, skin, and eye protection.	• The chemical substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either: - measured (or potential for) high concentration of atmospheric vapors, gases, or particulates, or - site operations and work functions involving a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of material that are harmful to skin or capable of being absorbed through the intact skin. • Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible. • Operations must be conducted in confined, poorly ventilated areas or until the absence of conditions requiring Level A protection is determined.	• Fully encapsulating suit material must be compatible with the substances involved.

DESCRIPTION OF PROTECTION LEVELS (continued)

	Equipment	Protection Provided	Should Be Used When:	Limiting Criteria
Level B	RECOMMENDED: • Pressure-demand, full facepiece SCBA or pressure-demand supplied-air respirator with escape SCBA • Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one-or two-piece chemical splash suit; disposable chemical-resistant one-piece suit). • Inner and outer chemical-resistant gloves. • Chemical-resistant safety boots/shoes. • Hard hat. • Two-way radio communications. OPTIONAL: • Coveralls • Disposable boot covers • Face shield • Long cotton underwear	The same level of respiratory protection but less skin protection than Level A. It is the minimum level recommended for initial entries until the hazards have been further identified.	• The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection. This involves atmospheres: - with IDLH concentrations of specific substances that do not represent a severe skin hazard; or - that do not meet the criteria for use of air-purifying respirators. • Atmosphere contains less than 19.5 percent oxygen. • Presence of incompletely identified vapors or gases as indicated by direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin.	• Use only when the vapors or gases present are not suspected of containing high concentrations of chemicals that are harmful to skin or capable of being absorbed through the intact skin. • Use only when it is highly unlikely that the work being done will generate either high concentrations of vapors, gases, or particulates or splashes of material that will affect unexposed skin.

DESCRIPTION OF PROTECTION LEVELS (continued)

	Equipment	Protection Provided	Should Be Used When:	Limiting Criteria
Level C	RECOMMENDED: • Full-facepiece, air-purifying, canister-equipped respirator. • Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one-or two-piece chemical splash suit; disposable chemical-resistant one-piece suit). • Inner and outer chemical-resistant gloves. • Chemical-resistant safety boots/shoes. • Hard hat. • Two-way radio communications. OPTIONAL: • Coveralls • Disposable boot covers • Face shield • Escape mask • Long cotton underwear	The same level of skin protection as Level B, but a lower level of respiratory protection.	• The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect any exposed skin. • The types of air contaminants have been identified, concentrations measured, and a canister is available that can remove the contaminant. • All criteria for the use of air-purifying respirators are met.	• Atmospheric concentration of chemicals must not exceed IDLH levels. • The atmosphere must contain at least 19.5 percent oxygen.

DESCRIPTION OF PROTECTION LEVELS (continued)

	Equipment	Protection Provided	Should Be Used When:	Limiting Criteria
Level D	RECOMMENDED: • Coveralls • Safety boots/shoes • Safety glasses or chemical splash goggles • Hard hat OPTIONAL: • Gloves • Escape mask • Face shield	No respiratory protection. Minimal skin protection.	• The atmosphere contains no known hazard. • Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.	• This level should not be worn in the Exclusion Zone. • The atmosphere must contain at least 19.5 percent oxygen.

SECTION 6

SAFETY PLANNING

Prior to conducting any field investigation, the Project Manager or geologist/engineer responsible for conduct of the investigation must provide the information as noted in the Site-Specific Health and Safety Plan form (Exhibit 2) and present this form to the Health and Safety Coordinator a minimum of one week prior to the start of field work. It is then the responsibility of the Project Manager or geologist/engineer to meet with all field personnel to acquaint them with the site-specific health and safety plan and to supply each member of the field team with a copy of the completed plan form. It is then the responsibility of each individual involved in the investigation to follow the procedures given in the site-specific health and safety plan. Failure to to so may be cause for termination or disciplinary action.

The following sections present procedures for conducting risk assessments, decontamination, emergency planning, and contingency planning. Since it is impossible to document all possible safety concerns and procedures which may be required, it is absolutely necessary that the Health and Safety Coordinator, Project Managers, and field personnel review the safety needs for each and every investigation prior to its conduct. The information presented in this manual is not meant to be all inclusive. The best procedure for avoiding a potential safety problem during the course of an investigation is to combine the information contained in this manual with the guidance of the Health and Safety Coordinator and good common sense.

6.1 Risk Assessment

The first step in a risk assessment is to identify the contaminants, their concentrations, and the locations where the contamination occurs. At a site where no environmental data exist, it may be possible to use data supplied by a client. However, it must be cautioned that this data may not always be reliable. Another source of data is to use information obtained from a previous investigation. This data may be more reliable but may not contain air monitoring results. However, it is possible to establish initial action levels from the identification and concentration of contaminants in soil and ground water samples. Another method of collecting on-site data is to conduct a site

EXHIBIT 2

SITE-SPECIFIC HEALTH AND SAFETY PLAN

This form must be completed a minimum of one (1) week prior to the start of work. It is the responsibility of the Project Manager to complete Items 1 through 10 and 14 and 15. All project personnel must receive a copy of this form and familiarize themselves with its contents.

1. Site name:

2. Work order No.:

3. Location (attach site map):

4. Project manager:

5. Project engineer(s)/scientist(s):

6. Period over which work is to be conducted:

7. Site description (include pertinent features on site map):

8. List of known contaminants (include locations and concentrations on site map):

Constituents	Location	Media	Concentration/ Volume	Depth

9. Planned site activities (be specific; include on site map and identify personnel per task):

10. Plant required health and safety procedures (i.e., hard hats, long-sleeved shirts, eyewear, etc...):

11. Safety srocedures (prepared by Safety Coordinator):

Procedure
Site Entry/Access
Monitoring
Egress
Decontamination

12. Action levels (prepared by Safety Coordinator):

Activity	Location	Action Level	Level of Protection

13. Contingency procedures (prepared by Safety Coordinator):

14. Emergency contacts (name and telephone number):

Police:
Fire:
Ambulance:
State/Federal Agency:
Plant Supervisor: On Duty Emergency Coordinator
Plant Health and Safety Officer:

15. Location of nearest hospital:

16. Special procedures and precautions:

Project Manager/Date

Safety Coordinator/Date

reconnaissance which would include a site walk-over using an OVM. This latter method is preferred and would result in the most site-specific and usable data with respect to establishing initial action levels.

After reviewing the existing data, the Health and Safety Coordinator will determine action levels on a per-task basis. Action levels are defined as those concentrations upon which a particular level of safety protection will be required. The site-specific health and safety plan will include initial action levels and protocols for both upgrading and downgrading the action levels on a per-task basis.

6.2 Site Entry

Each site-specific health and safety plan will also include a discussion of site entry procedures and zones of work. On a large, complex site where many zones of contamination exist, it will be necessary to predetermine the decontamination areas and contamination zones. This is of particular importance at a site where more than one activity is occurring simultaneously. Typical work zones are identified as follows:

- The exclusion zone in which work is being performed (well installation, test pits, etc.) and in which the highest level of protection is required.
- Contaminant reduction zone which is a buffering zone between the exclusion zone and the decontamination area. There should be limited access to this zone.
- Support zone where equipment and personnel are decontaminated.

Action levels will be established as required for each of these work zones in the site-specific health and safety plan.

6.3 Decontamination Procedures

Protective clothing and respirators help prevent the wearer from becoming contaminated when inhaling contaminants, while good work practices help reduce the contamination of protective clothing, instruments, and equipment. Even with these safeguards, contamination may occur. Harmful materials may transfer into clean

areas, exposing unprotected personnel. In removing contaminated clothing, personnel may come into contact with and/or inhale the contaminants. To prevent such an occurrence, contamination reduction and decontamination procedures must be developed and implemented for each specific investigation. As with all health and safety procedures, these must be predetermined and must continue throughout the period of the site operation unless site-specific conditions warrant a change.

Decontamination involves physically removing contaminants and/or converting them chemically into innocuous substances. The extent of decontamination depends upon a number of factors, the most important being the types of contaminants involved. The more harmful the contaminant, the more extensive and thorough decontamination must be. Less harmful contaminants may require less decontamination. Only very general guidance will be given in this manual on the methods and techniques for decontamination. At a minimum, for any activity requiring Level D, C, or B, the following decontamination materials and equipment must be available on-site:

- Plastic drop cloth for equipment and monitering meters
- Two metal wash tubs; one filled with a decontamination solution and another for containing rinse water
- A small sprayer or hose for rinsing
- Garbage bags for disposable items

Decontamination Procedures

Level B - Personal Protection Decontamination Procedure

The following is the procedure for full Level B decontamination:

Step 1 - Segregated Equipment Drop

Deposit equipment (tools, sampling devices, notes, monitoring instruments, radios, etc.) used on the site onto plastic drop cloths or into different containers which have plastic liners. It would be anticipated that sampling devices would have a higher potential for contamination than radios, clipboards, or monitoring instruments. Hence, a segregated drop reduces the probability of cross-contamination.

Needed Equipment: Containers of various sizes, plastic liners, plastic drop cloths.

Step 2 - Boot Covers and Glove Wash

Outer boot covers and outer gloves should be scrubbed with a decontamination solution of detergent and water.

Needed Equipment: Container (twenty to thirty gallons), decontamination solution (detergent/water solution), two or three long-handled, soft bristled scrub brushes.

Step 3 - Rinse Off Boot Covers and Gloves

Decontamination solution should be rinsed off boot covers and gloves using generous amounts of water, repeat as many times as necessary.

Needed Equipment: Containers (thirty to fifty gallons), high-pressure spray unit, water, two or three long-handled, soft bristled scrub brushes.

Step 4 - Tape Removal

Remove tape from around boots and gloves and place into container with plastic liner.

Needed Equipment: Container (twenty to thirty gallons), plastic liners.

Step 5 - Boot Cover Removal

Remove disposable boot covers and place into container with plastic liner.

Needed Equipment: Container (thirty to fifty gallons), plastic liners

Note that a bench or stool often expedites removal of boot covers.

Step 6 - Outer Glove Removal

Remove outer gloves and deposit in container with plastic liner.

Needed Equipment: Container (twenty to thirty gallons), plastic liners

Step 7 - Suit/Safety Boot Wash

Completely wash splash suit, SCBA, gloves, and safety boots. Generous amounts of decontamination solution (detergent/water solution) and long-handled, soft-bristled scrub brushes should be used to completely wash suit and safety boots. Care should be exercised that no water is allowed into the SCBA regulator. It is suggested that the SCBA regulator be wrapped in plastic.

Needed Equipment: Container (thirty to fifty gallons), decontamination solution (detergent/water solution), two or three long-handled, soft bristled scrub brushes, small buckets, sponge or cloth, and, if possible, a portable sprayer.

Step 8 - Suit/Safety Boot Rinse

Thoroughly rinse off all decontamination solution from protective clothing.

Needed Equipment: Container (thirty to fifty gallons), high-pressure spray unit, water, small buckets, two or three long-handled, soft bristled scrub brushes, and sponges or cloths.

Step 9 - Tank Changes

This is the last step in the decontamination procedure for those workers wishing to change air tanks and return to the exclusion zone. The worker's air tank is exchanged, new outer glove and boot covers are donned, and the joints are taped.

Needed Equipment: Air tanks, tape, boot covers, and gloves.

Step 10 - Removal of Safety Boots

Remove safety boots and deposit in container with a plastic liner.

Needed Equipment: Container (thirty to fifty gallons), plastic liners, boot jacket, and bench or stool.

Step 11 - SCBA Backpack Removal

Without removing face piece, the SCBA backpack should be removed and placed on a table. The face piece should then be disconnected from the remaining SCBA unit and the personnel should then proceed to the next Step.

Needed Equipment: Table

Step 12 - Splash Suit Removal

With care, remove splash suit. The exterior of the splash suit should not come in contact with any inner layers of clothing.

Needed Equipment: Container (thirty to fifty gallons), plastic liners, and bench or stool.

Step 13 - Inner Glove Wash

The inner gloves should be washed with a mild decontamination solution (detergent/water).

Needed Equipment: Decontamination solution (detergent/water solution), basin or bucket, and table.

Step 14 - Inner Glove Rinse

Generously rinse inner gloves with water.

Needed Equipment: Water, bucket, and table.

Step 15 - Face Piece Removal

Without touching face with gloves, remove face piece. Face piece should be deposited into a container which has a plastic liner.

Needed Equipment: Container (thirty to fifty gallons) and plastic liner.

Step 16 - Inner Glove Removal

Remove inner glove and deposit in container with plastic liner.

Needed Equipment: Container (twenty to thirty gallons) and plastic liners.

Step 17 - Inner Clothing Removal

Clothing soaked with perspiration should be removed. These clothes should be placed in a container with a plastic liner. Because of the small possibility of small amounts of contaminants to have been transferred to this clothing while removing the fully encapsulating suit, the inner clothing should not be worn off-site.

Needed Equipment: Container (thirty to fifty gallons) and plastic liners.

Step 18 - Field Wash

Wash hands and face. If highly toxic, skin corrosive, or inabsorbent materials are known or suspected to be present, a shower should be taken.

Needed Equipment: Water, soap, tables, buckets, field shower.

Step 19 - Redress

Put on clean clothes.

Needed Equipment: Tables, chairs, lockers, and a dressing trailer (needed in inclement weather).

Level C - Personal Protection Decontamination Procedure

This decontamination procedure will be the same as Level B personal protection except for:

Step 9 - Canister or Mask Change

If a worker leaves the exclusion zone to change canisters or masks, this is the last step the individual must go through. The canister or mask is changed, new outer gloves and boots are donned, and all open joints are taped.

Needed Equipment: Boot covers, outer gloves, tape, and mask or canister replacements.

Step 11 is removed from the decontamination procedure because no SCBA equipment is warranted at this level of protection.

Level D - Personal Protection Decontamination Procedure

At a Level D personal protection, respiratory protection is not utilized, therefore, the decontamination procedure is greatly simplified.

Step 1 - Segregated Equipment Drop

See Step 1, Level B Personnel Protection Decontamination Procedure.

Step 2 - Boot Wash

Wash boots with a solution of detergent and water.

Needed Equipment: Container (thirty gallons), decontamination solution (detergent/water), long-handled, soft-bristled scrub brushes.

Step 3 - Boot Rinse

Rinse off outside of boots.

Needed Equipment: Container (thirty gallons), high-pressure spray unit, and water.

Step 4 - Glove Wash

Wash gloves off with a detergent/water solution.

Needed Equipment: Container (thirty gallons) and water/detergent solution.

Step 5 - Glove Rinse

Rinse gloves off with water.

Needed Equipment: Container (thirty gallons), high-pressure spray unit, and water.

Step 6 - Remove Boots

Remove boots and store or deposit in a plastic-lined container.

Needed Equipment: Container (thirty to fifty-five gallons) and plastic liners.

Step 7 - Remove Gloves

Remove gloves and deposit in a plastic-lined container.

Needed Equipment: Container (twenty gallons) and plastic liners.

Step 8 - Coverall Removal

Remove coverall and place in plastic-lined container.

Needed Equipment: Container (thirty gallons) and plastic liners

Step 9 - Field Wash

Wash hands and face.

Needed Equipment: Water, soap, tables, and buckets.

6.4 Emergency Planning

For any field investigation, regardless of the action level required, common sense dictates certain emergency plans be made. For any site, these should at a minimum include the following:

- The location and telephone number of the nearest emergency room or hospital
- The location of the nearest telephone
- The quickest and easiest route for exiting a site
- The telephone numbers for local police; fire department; emergency response team; toxicity or poison control center

It is impossible in this manual to account for all possible emergency situations or procedures required during an investigation. Once again, good common sense should prevail in any emergency situation.

6.5 Contingency Planning

Before going on-site, it is the responsibility of every individual or project team to develop contingency plans. For most investigations, this is a minimal effort. It simply requires predetermining the procedures to use in case of an emergency, or in case of a change in action level. The simplest contingency plan is one where the individual exits the site or the exclusion zone and either rethinks the procedures to be employed or calls his/her Project Manager or Health and Safety Coordinator for guidance. Once again, as repeated so often in this manual, health and safety is so much a matter of common sense. If an individual is in a situation he/she can neither comprehend nor react to, then he/she should simply exit the site.

SECTION 7

GENERAL SAFETY PRACTICES

As stated previously, prior to any field investigation, all field personnel will be instructed in the proper use of equipment, clothing, materials, and the necessary procedures for safely conducting the investigation or task. However, in all cases (except where noted below), the following general safety practices must be followed (failure to do so may be cause for termination or disciplinary action):

- Eating, drinking, chewing gum or tobacco, smoking, applying cosmetics, or any practice that increases the probability of hand to mouth transfer and ingestion of material is prohibited in any area designated as being contaminated.
- Food, beverages, tobacco products, etc., are prohibited in any area designated as being contaminated.
- Hands and face must be thoroughly washed upon leaving the work area, and before eating, drinking, or any other activities.
- Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.
- No excessive facial hair, which interferes with the satisfactory fit of the mask to face seal, is allowed on personnel required to wear respiratory protective equipment.
- Contact with contaminated surfaces or with surfaces suspected of being contaminated should be avoided. Whenever possible, one should not walk through puddles, mud, or other discolored surfaces; kneel on ground; lean, sit, or place equipment on drums, containers, vehicles, or the ground.

- Medicine and alcohol can potentiate the effects of exposure to toxic chemicals and, therefore, should not be taken by personnel requiring protective clothing.

- Personnel and equipment in the contaminated area should be minimized, consistent with effective site operations.

- Work areas for various operational activity should be established.

- Procedures for leaving a contaminated area must be planned and implemented prior to going to the site. Work areas and contamination procedures must be established on the basis of prevailing site conditions.

- No one requiring the use of respiratory protection via full-face respirators or self-contained breathing apparatus can wear contact lenses.

- No one required to work under Level B protection will be allowed to work alone.

- No one will enter a confined space without first consulting with the Health and Safety Coordinator.

- In extreme hot or cold weather, personnel wearing Level D, C, and B safety gear should take appropriate rests to avoid heat stress and/or hyperthermia.

- Some types of protective materials conduct heat and cold readily. In cold conditions, natural material clothing should be worn under the protective clothing. Protective clothing should be removed prior to allowing a person to "get warm". Applying heat such as a space heater to the outside of the protective clothing may drive the contaminants through. In hot weather, underclothing will absorb perspiration. It is recommended that all cotton undergarments be worn. In fact, the best protection against heat stress is to wear cotton long underwear beneath the protective garment.

- Respirators will be issued for the exclusive use of one worker and will be cleaned and disinfected after each use.

- Safety gloves and boots shall be taped to the disposable, chemical-protective suits.

- All unsafe equipment left unattended will be identified by a "DANGER, DO NOT OPERATE" tag.

- Noise mufflers or ear plugs may be required for personnel working around heavy equipment. Disposable, form-fitting plugs are preferred.

- Cartridges for air-purifying respirators will be changed daily at a minimum.

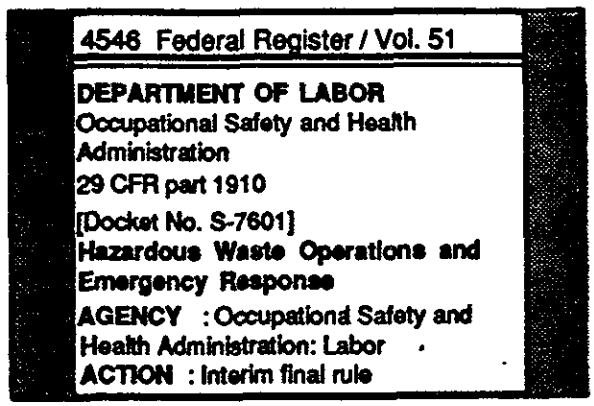
- Self-contained breathing apparatus (SCBA) and air-purifying respirators will be inspected daily by the Site Safety Officer.

REGULATORY REQUIREMENTS

OVERVIEW

Introduction

Under Section 126(e) of the Superfund Amendments and Reauthorization Act of 1986, the Department of Labor was directed to develop health and safety standards to protect employees involved in hazardous waste operations and during emergency response to hazardous substance incidents. In response, the Occupational Safety and Health Administration (OSHA) published an interim final rule on December 19, 1986 which establishes regulations in 29 CFR 1910.120. These interim regulations will remain in effect for one year after OSHA promulgates final rules (which are due by October 17, 1987).



4546 Federal Register / Vol. 51

DEPARTMENT OF LABOR
Occupational Safety and Health Administration
29 CFR part 1910
[Docket No. S-7601]
Hazardous Waste Operations and Emergency Response
AGENCY : Occupational Safety and Health Administration: Labor
ACTION : Interim final rule

Effective Dates

The effective dates of the interim regulations were phased in from December 19, 1986 to March 16, 1987. Operations covered by this standard which are started after March 16, 1987 must be in compliance from the start of the operations.

Hazardous Substances

A hazardous substance is defined as any substance which adversely affects the health or safety of employees upon exposure:

- any substance defined in section 101(14) of CERCLA,
- any biological agent and other disease-causing agent as defined in Section 101(33) of CERCLA,
- any substance listed by the U.S. Department of Transportation and regulated as hazardous materials under 49 CFR 172.101 and appendices, and
- hazardous waste as defined in 40 CFR 261.3.

Hazardous Waste Operations

Hazardous waste operation is defined as any operation with activities that expose employees to hazardous wastes, hazardous substances, or any combination of hazardous wastes or hazardous substances.

Operations Covered

Employers and employees engaged in the following operations are covered by the requirements of 29 CFR 1910.120.

Cleanup Operations

- Superfund (CERCLA) Hazardous Substance Response Operations
- Major corrective actions in operations under the Resource Conservation and Recovery Act (RCRA)
- State or local government-designated hazardous waste operations
- Post-emergency response operations to hazardous substance releases

Treatment, Storage, or Disposal Facilities (TSDs)

- Hazardous waste treatment, storage, or disposal facilities with interim status or permitted under RCRA

Emergency Response Operations

- On-Site Emergency Response Operations
  - Emergency response to hazardous substance incidents at cleanup operations
- Off-Site Emergency Response Operations
  - Employers whose employees are responsible for responding to on-premise hazardous substance (emergency response) incidents

- Employers whose employees may respond to off-premise hazardous substance (emergency response) incidents

- Non-facility emergency response personnel who may be called upon to respond to hazardous substance incidents involving a plant location, a railroad tank car, or motor carrier tank truck, (e.g., a fire department, medical/first aid squad)

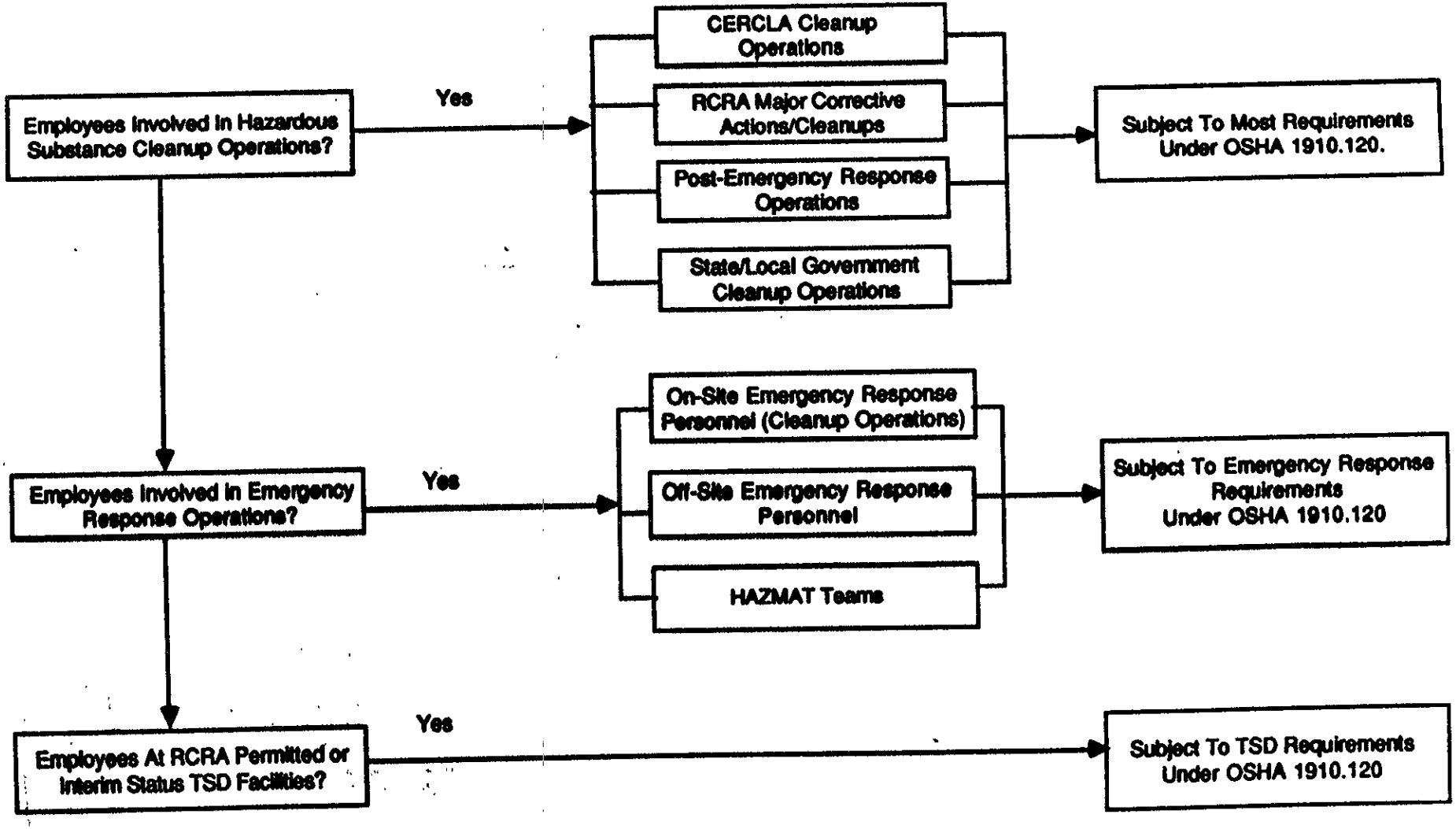
• Operations Which May Respond to Both On-Site and Off-Site Emergency Incidents

- HAZMAT teams

Note that employees who will not be exposed to or do not have the potential to be exposed to hazardous substances are not covered by this interim final rule.

You can use the OSHA 1910.120 flow chart (page I-4) and Table I-1 (page I-5) to determine which of the requirements apply to your operation(s).

OSHA 1910.120
APPLICABILITY FLOW CHART



OSHA 1910.120 Requirements

	Requirements	CERCLA Hazardous Substances Cleanups	RCRA Cleanup Corrective Actions	State/Local Government Cleanups	Post-Emergency Response Personnel	TSD Facilities	Emergency Response Personnel	HAZMAT Teams
Cleanup Operations	Site characterization and analysis	X	X	X	X			
	Site control	X	X	X	X			
	On-site training requirements	X	X	X	X			
	Medical surveillance	X	X	X	X	X		X
	Engineering controls, work practices, PPE	X	X	X	X			
	Monitoring	X	X	X	X			
	Informational programs	X	X	X	X			
	Handling drums and containers	X	X	X	X			
	Decontamination	X	X	X	X	X		
	Illumination	X	X	X	X			
	Sanitation	X	X	X	X			
Emergency Response Operations	On-site emergency response Training/Procedures	X	X	X	X			X[1]
	Off-site emergency response Training/Procedures					X	X	X[2]
	HAZMAT Teams Requirements							X
TSD Operations	Safety and Health Program					X		
	TSD Training Requirements					X		
	OSHA Hazard Communication Program					X		

[1] Applies if HAZMAT Team responds to on-site emergency incidents

[2] Applies if HAZMAT Team responds to off-site emergency incidents

Implementation Schedule

Date	Action
December 19, 1986	EPA published Interim Final Rule, to be effective until one year after Final Rule is published.
December 19, 1986	Requirements of Act become effective, except those with specific start-up dates, or those which are required by other OSHA standards.
February 16, 1987	**Site Safety and Health Plan must be completed.**
March 16, 1987	**Initial training and medical surveillance program must be fully implemented.** **Safety and Health Program must be completed.** **Engineering Controls, Work Practices, and Personal Protective Equipment requirements must be fully implemented.** **RCRA TSD facilities must implement their requirements under this standard.**
October 17, 1987	OSHA must promulgate Final Rule.
One year after Final Rule published.	Final Rule becomes effective.

Introduction

Employers involved in hazardous substance cleanup operations must meet nearly all the requirements under the rule since their employees are likely to have the highest exposures to hazardous substances. These operations include:

- hazardous substance response operations under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), including initial investigations at CERCLA sites before the presence or absence of hazardous substances has been ascertained;
- major corrective actions taken in cleanup operations under the Resource Conservation and Recovery Act (RCRA);
- hazardous waste sites that have been designated for cleanup by state or local government authorities; and
- post-emergency response operations to releases of hazardous substances.

Overview of the Requirements

An employer must develop and implement a Safety and Health Program for employees involved in hazardous waste cleanup operations. The program should be designed to identify, evaluate, and control safety and health hazards and include provisions for emergency response at the cleanup site. At a minimum, the program should incorporate the requirements outlined in this interim final rule including:

- **Site characterization and analysis** - Identification of specific site hazards and appropriate safety and health control procedures for employee protection.
- **Site control** - Development of a program for preventing employee exposure to hazardous substances.
- **Employee training** - Training of employees exposed to hazardous substances, health or safety hazards.
- **Medical surveillance program** - Medical surveillance of employees exposed to hazardous substances at or above the permissible exposure level (PEL) or who wear a respirator for thirty days or more per year or HAZMAT employees.

- **Engineering controls, work practices, and personal protective equipment** -Implementation of all or a combination of these methods to protect employees from exposure to hazardous substances or health hazards.
- **Monitoring** - Air monitoring at the site to determine appropriate level of employee protection needed.
- **Informational program** - Development and implementation of site safety and health plan.
- **Material handling** - Requirements for safe handling of hazardous substances, and contaminated soils, liquids, and other residues.
- **Decontamination procedures** - Develop decontamination procedures, communicate to employees and implement before employees, equipment are exposed to hazardous substances.
- **"On-site" emergency response training and procedures** - Develop an emergency response plan including training and emergency procedures.
- **Illumination** - Assure that work areas are properly illuminated.
- **Sanitation** - Provide adequate facilities (washing, toilet, food, sleeping) at temporary work sites.

Additional Requirements

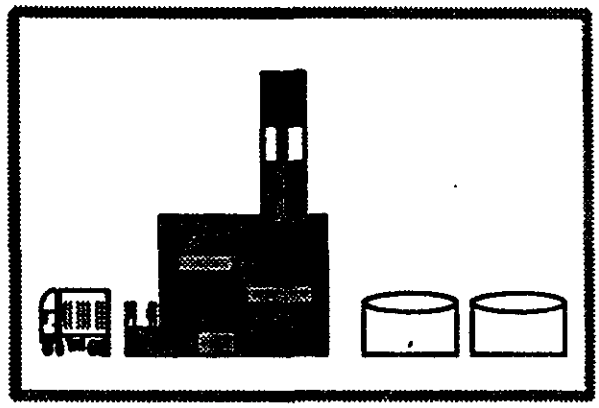
The existing OSHA requirements which cover excavation in Subpart P of 29 CFR 1926 already apply to cleanup operations but are repeated in the interim final rule to emphasize their importance at hazardous waste sites.

In addition, employers must notify contractors and subcontractors of the hazards identified by the employer at the hazardous waste cleanup operation. This requirement is intended to protect employees of contractors and to involve contractors in the safe operations of the hazardous waste site.

Introduction

RCRA-permitted or interim status hazardous waste treatment, storage, or disposal (TSD) facilities are required to implement:

- OSHA Hazard Communication Standard
- Medical Surveillance Program
- Safety and Health Program
- Decontamination Program
- Worker Job Training Program



OSHA Hazard Communication Standard

The OSHA Hazard Communication Standard generally applies to chemical manufacturers and importers, and employers within SIC codes 20 through 39 (manufacturing). This new OSHA regulation extends the Hazard Communication Standard to TSDs.

Medical Surveillance Program

The interim final rule includes provisions for both initial or baseline and periodic medical examinations. The examinations are to be provided to those employees:

- who are or may be "routinely" exposed to hazardous substances or health hazards at or above the permissible exposure limit for these substances for thirty days or more a year (without regard to use of respirators);
- who "routinely" wear a respirator for thirty days or more a year; or
- who are members of a HAZMAT team while engaged in hazardous waste operations.

Employers are required to:

- provide medical examinations,

- provide exams without cost or loss of pay,
- provide information to doctors,
- provide a copy of the physician's written opinion to employee,
- adhere to a schedule of medical exams, and
- maintain medical records.

Safety and Health Program

Employers must develop and implement a safety and health program for employees involved in hazardous waste operations. The program must be designed to:

- identify, evaluate, and control safety and health hazards; and
- provide for employee protection during an emergency response at their facilities.

Decontamination Program

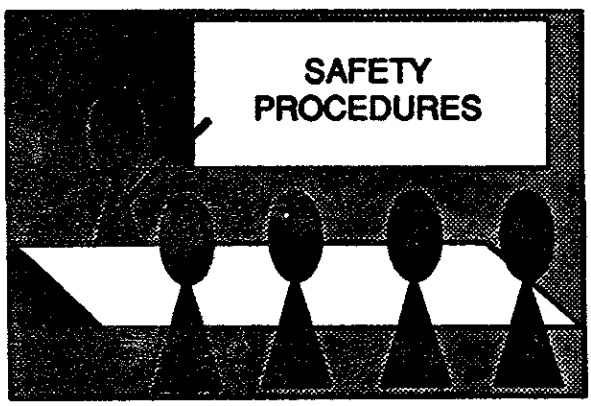
A decontamination procedure must be developed, communicated to employees, and implemented before any employees or equipment can enter any areas where the potential for exposure to hazardous substances exists. Employers must:

- develop standard operating procedures to minimize employee contact with hazardous substances or equipment that has contacted hazardous substances;
- ensure that decontamination of equipment is performed in an area that will minimize the exposure of uncontaminated employees or equipment;
- ensure that all contaminated clothing and equipment be appropriately disposed or decontaminated;
- monitor decontamination procedures to determine their effectiveness (the site safety and health officer must conduct the monitoring and take appropriate steps to correct any inefficiencies);

- decontaminate or dispose of all equipment and solvents used for decontamination and impermeable clothing likely to have contacted hazardous substances;
- decontaminate, clean, launder, maintain, or replace protective clothing as needed to maintain its effectiveness;
- inform commercial laundries or cleaning establishments of the potentially harmful effects of exposure to hazardous substances on contaminated protective clothing; and
- provide showers and change rooms where needed.

Worker Job Training Program

Employers must provide a training program for employees working at hazardous waste operations that assists employees to perform their duties in a safe manner so as not to endanger themselves or other employees. The initial training must be for 24 hours, with refresher training provided for 8 hours annually.



Emergency Response Operations

Introduction

Emergency response employees who respond or will respond to incidents involving hazardous substances are covered by this interim final rule. There are general requirements for all emergency responses and specific requirements for "on-site" or "off-site" emergency response operations.

On-Site Emergency Response

On-site emergency response requirements apply to emergency response activities at certain cleanup "sites", including:

- CERCLA cleanup operations,
- RCRA corrective action operations,
- state or local government cleanup operations, and
- post-emergency response cleanup operations.

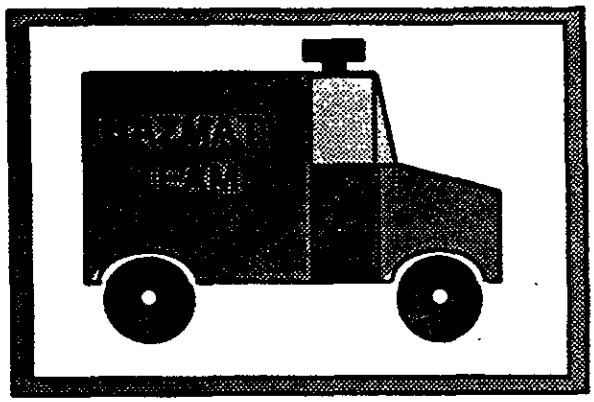
Off-Site Emergency Response

Off-site emergency response requirements apply to emergency response activities which do not occur at a cleanup site. Off-site requirements apply to employers whose employees respond or may respond to "on-premise" and/or "off-premise" hazardous substance incidents including:

- employees who respond to hazardous substance incidents from their work stations such as the facility fire brigade;
- employees who respond to off-premise hazardous substance incidents from their work stations such as a facility HAZMAT team responding to a transportation accident;
- emergency responders who are not facility employees such as the fire department or first aid squad who could respond to hazardous substance incidents at a plant, on the highway, in the waterways, etc.; and
- employers of specially trained HAZMAT teams (usually the fire departments) who are called upon to control or handle on- or off-premise hazardous substances incidents.

HAZMAT Teams

Employees who are members of the HAZMAT Team are required to have the same training as off-site emergency response personnel, unless they also respond to on-site emergency incidents. In this case, the on-site emergency response training requirements would also apply. They are also required to have an annual physical examination and be provided medical surveillance when necessary. The personal protective equipment and clothing used by members of the HAZMAT team must meet certain specifications outlined in the interim final rule.



Definitions

"Emergency Response" is defined as a coordinated effort by employees from outside the immediate release area or by outside reponders (i.e., mutual-aid groups, local fire departments, etc.) to an occurrence which results, or is likely to result in an uncontrolled release of a hazardous substance. Response to incidental releases that can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area are not considered to be emergency responses within the scope of this standard. Responses to releases of hazardous substances which are below the "established permissible exposure limits" established in this standard are not considered to be emergency responses.

Established Permissible Exposure Limit means the inhalation or dermal permmissible exposure limit specified in

- 29 CFR 1910, Subpart Z, or if none is specified;
- the exposure limits in "NIOSH Recommendations for Occupational Health Standards" dated September 1986 incorporated by reference, or if neither of the above is specified;
- the standards specifed by the American Conference of Governmental Industrial Hygienists in their publication titled "Threshold Limit Values and Biological Exposure Indices for 1986-87 dated 1986 incorporated by reference, or if none of the above is specified, a limit based upon a published study or manufacturer's safety data sheet brought to the employer's attention.

DRAFT

DATE

ADDRESS

Dear Client:

I am sure you are aware of the provisions of OSHA's Interim Final Rule (29 CFR 1910.120) which covers employees engaged in hazardous waste site activities. This rule mandates increased training, medical examinations, respiratory certification, and record keeping.

ERM has taken the steps necessary to assure compliance with these regulations on the part of its employees. We are notifying all of our subcontractors of the rule, supplying site-specific health and safety plans, and requiring compliance on their part. Some additional, specific steps include:

- Review and revision, as needed, of all site health and safety plans.
- Review of our existing medical programs and training for compliance with OSHA 1910.120.
- Additional and ongoing training including project supervision and health and safety training pertinent to our hazardous waste site activities.

As you know, these additional steps are necessary to provide our clients with quality service in compliance with the regulations. These necessary costs of compliance will be billed as part of ERM's services. In most cases, they will have minor impact, however, we feel obliged to draw such a matter to your attention.

If you have any questions, please let me know. Moreover, if ERM can be helpful in developing training materials for use by your company, please contact me.

Sincerely,

_____

ERM Project Manager

DRAFT

PROPOSED FORM

Dear ERM Subcontractor:

You executed an agreement with ERM dated _____ to supply (drilling, backhoe, etc.) services which are to be performed at _____ (specify the site). In that document, you agreement to comply with all pertinent regulations. While implementation of compliance remains your responsibility, by this letter we are bringing to your attention OSHA's regulation (29 CFR 1910.120) which covers employees engaged in hazardous waste site activities. This rule requires numerous items, including: training, medical examinations, respiratory certification, and record keeping.

ERM has taken steps to ensure compliance with these regulations. As part of our program, we are requiring certification of compliance by our subcontractors in the form attached to this letter. For our subcontractors engaged in ongoing activities, we are requiring return of this certification within fifteen (15) calendar days.

The OSHA rule requires preparation and use of the Site Health and Safety Plan as a method of sharing information on potential hazards and site practices. These plans generally have been shared with subcontractors at the initiation of each job. For reference purposes, we are enclosing a copy of the Site Health and Safety Plans for the above referenced site. Our certification letter also requires acknowledgment of receipt by you of this document.

Please be advised that ERM requires that, as a minimum, its subcontractors implement health and safety practices set forth in the plan during all phases of field work under our agreement. Our client may from time to time require additional measures. If you have any questions or suggestions related to implementation of these practices, you are requested to contact us immediately.

If you do not have a copy of the new OSHA regulation published in the December 19, 1986 Federal Register, we shall be happy to provide one to you.

We want to thank you for your attention to this matter.

_____

Project Manager
ERM, Inc.

DRAFT

ENVIRONMENTAL RESOURCES MANAGEMENT, INC.

III. SUBCONTRACTOR OCCUPATIONAL SAFETY AND HEALTH CERTIFICATION

PROJECT: _____

CONTRACTOR: _____

1. Contractor certifies that the following personnel to be employed on the subject project have met the following requirements of the OSHA Hazardous Waste Operations Standard (29 CFR 1910.120) and other applicable OSHA standards (see attached).

Contractor Personnel	Training		Respirator Certification		Medical Examination	
	Yes	No	Yes	No	Yes	No
_____	_____		_____		_____	
_____	_____		_____		_____	
_____	_____		_____		_____	
_____	_____		_____		_____	

2. Contractor certifies that it has received a copy of the Site Health and Safety Plan and will ensure that its employees are informed and will comply with its requirements.

3. Contractor further certifies that it has read and understands and will comply with all provisions of its contractual agreement with Environmental Resources Management, Inc.

Signed: _____ **Date:** _____

Title: _____

Develop an Emergency Response Plan

Employers whose employees may be involved in hazardous substance emergency response operations must develop an emergency response plan which addresses:

- pre-emergency planning,
- personnel roles, lines of authority, training and communication,
- emergency recognition and prevention,
- safe distances and places of refuge,
- site security and control,
- evacuation routes and procedures,
- decontamination,
- emergency medical treatment and first aid,
- emergency alerting and response procedures,
- critique of response and follow-up, and
- personal protective equipment (PPE) and emergency equipment.

There are additional requirements for the plan, depending upon whether the employees are responding to on-site (cleanup operations) or off-site emergency incidents.

Provide Employee Training

Employers must provide training to ensure the protection of employees responding to hazardous substance emergency response incidents. Because of the increased risk facing employees involved in on-site emergency response operations, the training requirements are more stringent.

A. On-Site Emergency Response Training

OSHA is requiring the training of on-site emergency response personnel to be identical to the training for other employees involved in on-site hazardous waste operations (e.g., CERCLA and RCRA cleanup sites). In addition, site emergency response personnel must also be trained in the necessary skills for anticipated, site-specific emergency response activities.

B. Off-Site Emergency Response Training

Training must be conducted on a monthly basis totaling 24 hours annually and should include recognition of hazards; selection, care, and use of personal protective equipment; and safe operating procedures to be used during an incident.

OSHA has stated that this training requirement may be met with related training provided under other regulatory programs and that employers simply need to document such training. Examples of related training include:

- EMT
- Use of personal protection equipment, emergency equipment
- Communications and alarm systems
- Response to fires, explosions
- Shutdown of operations

In addition, an employee covered by both the training requirements of a TSD facility as defined in the TSD Operations section and those of off-site emergency response are only required to have a total of 24 hours initial training, not 48 hours.

ERM Health and Safety Matrix

(1) ERM EMPLOYEES
(2) ERM SUBS/EMPLOYEES
(3) OTHERS

TASKS VS. SOURCE OF REQUIREMENT

TASK	OSHA LAW	1910·120	INDUSTRY PRACTICES	CONTRACTS	COMPANY POLICY AND PROCEDURES
GENERAL COMPLIANCE	SAFE AND HEALTHFUL WORKPLACE			Req'd	Req'd
TRAINING INITIAL OFFSITE. ONSITE. SUPERVISORY PERIODIC CREDIT		 40-HR 24-HR 8-HR 8-HR Prior education & training			(1) Interim program • Build an existing program • This is 8-HR supplement/update • Special training in CPR. First aid. etc.
MEDICAL RECORDS. RESP. CERT.		 Req'd Req'd			(1) Exisiting Occ. Med. program •Work related deficiencies noted
HAZARD COMMUNI-CATION	STATE HAZCOM	Health & Safety Plan			-Notify subs of 1910:120 -Certify Compliance -Copy H&S Plan -Job tailgate meetings
ENFORCE MENT FIELD PRACTICES. HARD HAT. RESPIRATOR CLOTHING OTHER TRAINING. MEDICAL COMMUNI-CATION				Often Required (1) & (2)	(1) Fully Required; field and other (2) (subs)...Advise of field deficiency; call home base if not corrected (2) Project Manager requires certification and relies on it
HEALTH & SAFETY PLAN		Req'd			Req'd Budget Review

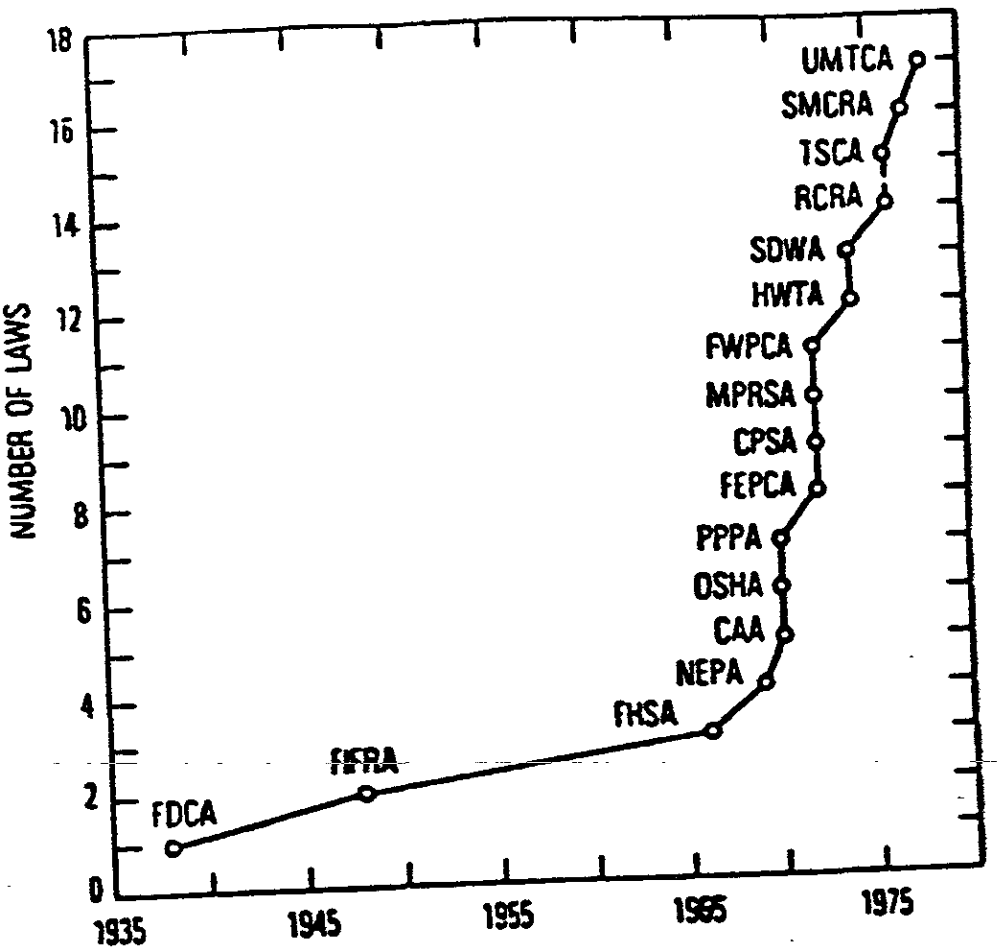
ERM Health and Safety Matrix

(1) ERM EMPLOYEES
(2) ERM SUBS/EMPLOYEES
(3) OTHERS

TASKS VS. SOURCE OF REQUIREMENT

TASK	OSHA LAW	I910:120	INDUSTRY PRACTICES	CONTRACTS	COMPANY POLICY AND PROCEDURES
GENERAL COMPLIANCE	SAFE AND HEALTHFUL WORKPLACE				
TRAINING INITIAL OFFSITE. ONSITE. SUPERVISORY PERIODIC CREDIT					
MEDICAL RECORDS. RESP. CERT.					
HAZARD COMMUNI-CATION					
ENFORCE MENT FIELD PRACTICES. HARD HAT. RESPIRATOR CLOTHING OTHER TRAINING. MEDICAL COMMUNI-CATION					
HEALTH & SAFETY PLAN					

Number of Environmental Protection Laws Versus Years



LIST OF ACRONYMS

WMA	Wholesome Meat Act (1967)
WPPA	Wholesome Poultry Products Act (1968)
EPIA	Egg Products Inspection Act (1970)
FHSA	Federal Hazardous Substances Act (1966)
CPSA	Consumer Product Safety Act (1972)
PPPA	Poison Prevention Packaging Act (1970)
LBPPPA	Lead-Based Paint Poison Prevention Act (1973, amended 1976)
HMTA	Hazardous Materials Transportation Act (1970)
PWSA	Ports and Waterways Safety Act (1972)
DCA	Dangerous Cargo Act (1952)
AEA	Atomic Energy Act (1954)
BFCLA	Bulk Flammable and Combustible Liquids Act
PPIA	Poultry Products Inspection Act
FMIA	Federal Meat Inspection Act
CAA	Clean Air Act (1970, amended 1977)
FWPCA	Federal Water Pollution Control Act (1972, amended 1977, 1978)
SDWA	Safe Drinking Water Act (1974, amended 1977)
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act (1948, amended 1972)
PRA	Pesticide Residues Amendment (1954, amended 1972)
MPRSA	Marine Protection, Research and Sanctuaries Act (1972)
RCRA	Resource Conservation and Recovery Act (1976)

LIST OF ACRONYMS (continued)

TSCA	Toxic Substances Control Act (1976)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (1981)
OSHA	Occupational Safety and Health Act (1970)
FDCA	Food, Drug and Cosmetic Act (1932)
DOT	Department of Transportation
EPA	Environmental Protection Agency
FDA	Food and Drug Administration

SELECTED REFERENCES FOR ERM HEALTH AND SAFETY TRAINING PROGRAM

1. 40 CFR Part 300 National Oil & Hazardous Pollution Contingency Plan.

2. ANSI Z88.6, 1984, American National Standard for Respiratory Protection, American National Standards Institute, New York, New York.

3. U.S. EPA, 1984, Characterization of Hazardous Waste Sites - A Methods Manual, Vol. II, Available Sampling Methods, 2nd Edition, EPA 600/4-84-076.

4. ACGIH, 1986-87, Threshold Limit Values and Biological Exposure Indices with Intended Changes, American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio.

5. ANSI Z88.2, 1980, Practices for Respiratory Protection, American National Standards Institute, New York, New York.

6. OSHA, March 30, 1984, Industrial Hygiene Technical Manual, OSHA Instruction CPL 2-2.20A.

7. U.S. EPA, 1984, Standard Operating Safety Guides, EPA Office of Emergency and Remedial Response, Hazardous Response Support Division, Edison, NJ.

8. NIOSH, 1979, Criteria for a Recommended Standard: Working in Confined Spaces, NIOSH #80-106.

9. U.S. DOT, 1984, Emergency Response Guidebook, DOT P5800.3, U.S. Department of Transportation, Washington, D.C.

Other Sources of Information

NIOSH/OSHA/USCG/EPA - "Occupational Safety & Health Guidance Manual for Hazardous Waste Site Activities"
Oct. 1985
Prepared by NIOSH, OSHA, USCG, EPA

Suspect Chemical Sourcebook; fifth edition, 1986, edited by Kenneth B. Clansky, Roytech Publications, Inc.

Handbook of Toxic & Hazardous Chemicals, 1981, Marshall Sitting Noyes Publications, Park Ridge, N.J.

Handbook of Environmental Data on Organic Chemicals, 2nd edition, 1983, Karel Verschueren, Van Nostrand Reinhold Co., N.Y.

Phone Nos.

TSCA Assistance Office - #1-800-424-9065
NIOSH Office - #1-513-841-4287
RCRA Hotline - #1-800-424-9346
Radiation Office - #1-202-382-7400
OSHA - #1-202-523-8151