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Environmental Protection
Agency

Office of Solid Waste and
Emergency Response
(5201G)

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Superfund

EPA

# Safety and Health Decision-Making for Managers (165.8)

# Student Manual

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# Safety and Health Decision-Making For Managers (165.8)

## Orientation and Introduction

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# SAFETY AND HEALTH DECISION-MAKING FOR MANAGERS (165.8)

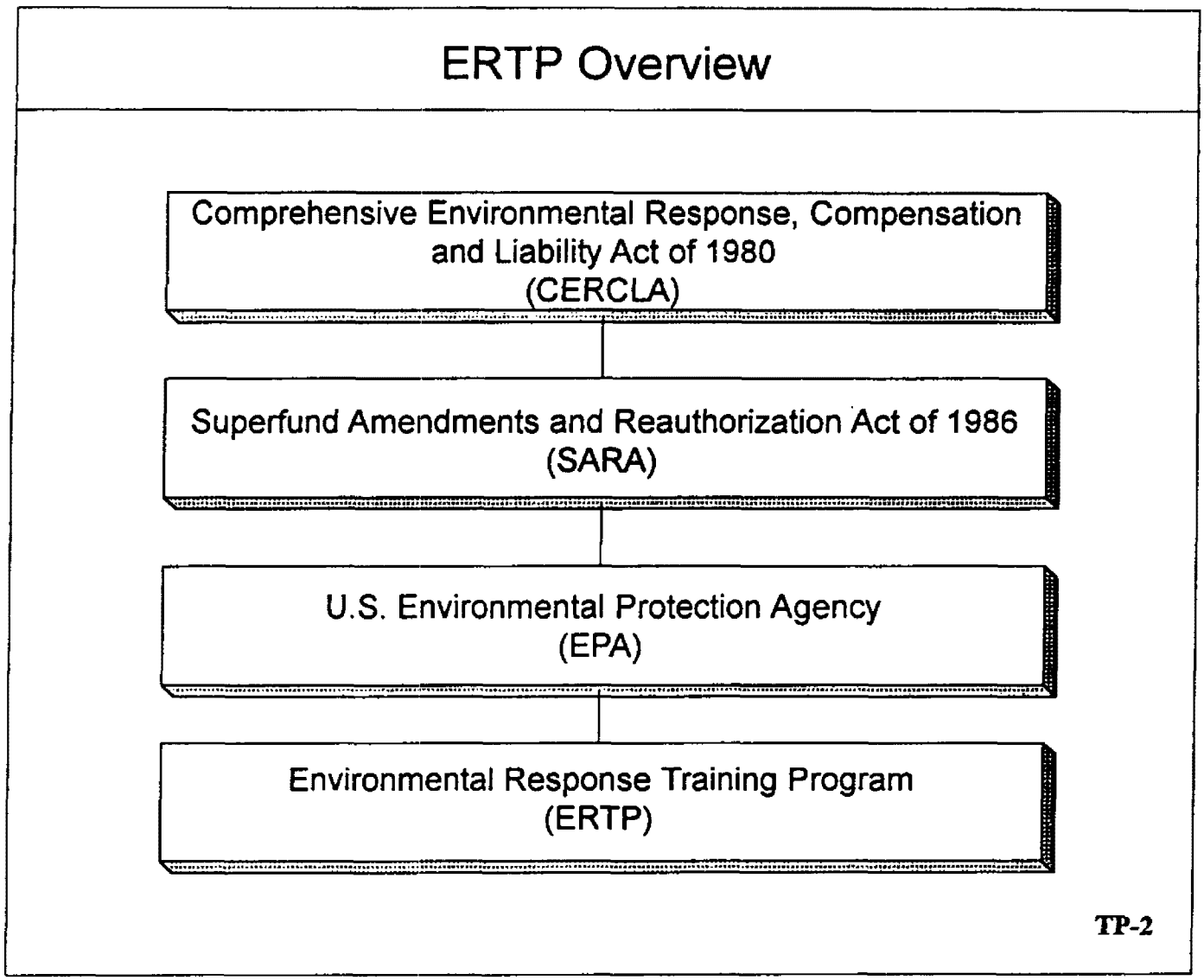
Presented by:
Tetra Tech NUS, Inc.
EPA Contract No. 68-C7-0033

**TP-1**

## *Orientation and Introduction*

Agenda:

- Environmental Response Training Program (ERTP) overview
- Synopsis of ERTP courses
- Course layout and agenda
- Course materials
- Facility information




## *ERTP Overview*

In 1980, the U.S. Congress passed the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), also known as Superfund. In 1986, the Superfund Amendments and Reauthorization Act (SARA) was passed. This act amended CERCLA. CERCLA provides for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and for the cleanup of inactive waste disposal sites. The U.S. Environmental Protection Agency (EPA) allocated a portion of Superfund money to training. EPA's Environmental Response Team (ERT) developed the Environmental Response Training Program (ERTP) in response to the training needs of individuals involved in Superfund activities.

**CEU**

**Continuing Education Units (CEUs)**

1.65 CEUs: 100% attendance at this course
≥ 70% on the exam

**ABIH**

**American Board of Industrial Hygiene (ABIH) Certification Maintenance (CM) Points**

ABIH has awarded this course 2.0 CM point, and the CM approval number is 1898. Certified Industrial Hygienists (CIHs) with an EPA course completion certificate may apply for this CM point.

**OSHA**

**Occupational Safety and Health Administration (OSHA)**

This course meets and exceeds OSHA's requirement [29 CFR 1910.120(e)(4)] of a minimum of 8 hours of additional specialized training for supervisors of hazardous waste workers.

TP-3

## Health and Safety Courses

- *Hazardous Materials Incident Response Operations (165.5)*
- *Safety and Health Decision-Making for Managers (165.8)*
- *Emergency Response to Hazardous Material Incidents (165.15)*

TP-4

## Technical Courses

- *Treatment Technologies for Superfund (165.3)*
- *Air Monitoring for Hazardous Materials (165.4)*
- *Risk Assessment Guidance for Superfund (165.6)*
- *Introduction to Groundwater Investigations (165.7)*
- *Sampling for Hazardous Materials (165.9)*
- *Radiation Safety at Superfund Sites (165.11)*
- *Introduction to Environmental Geophysics (165.20)*

TP-5

## Special Courses

- *Health and Safety Plan Workshop (165.12)*
- *Designs for Air Impact Assessments at Hazardous Waste Sites (165.16)*
- *Removal Cost Management System (165.17)*
- *Inland Oil Spills (165.18)*

TP-6

## Courses Offered in Conjunction with Other EPA Offices

✓ *Chemical Emergency Preparedness and Prevention Office (CEPPO)*
- *Chemical Safety Audits (165.19)*

TP-7

✓ *Site Assessment Branch*
- *Introductory Preliminary Assessment Training*
- *Introductory Site Investigation Training*
- *Federal Facilities Preliminary Assessment/Site Investigation*
- *Hazard Ranking System*
- *Hazard Ranking System Documentation Record*

TP-8

- Identify sections of 29 CFR 1910.120 that relate to operations at hazardous waste sites.
- Identify regulations, consensus standards, and guidance documents developed by OSHA, EPA, the National Institute of Occupational Safety and Health (NIOSH), the American National Standards Institute (ANSI), and the National Fire Protection Association (NFPA) that pertain to personnel engaged in field operations.

TP-9

- Develop elements of a site safety plan that include medical monitoring, air surveillance strategies, and personal protective equipment (PPE).
- Conduct an audit of a health and safety plan (HASP) using EPA's Health and Safety Audit Guidelines document.
- Identify computer software programs available through EPA that will aid in the development of a HASP.

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## About the Agenda

- Agenda times are only approximate. Every effort is made to complete modules and to finish the day at the specified time.
- Class begins promptly at 8:15 a.m. on Tuesday and at 8:00 a.m. on Wednesday and Thursday. Please arrive on time to minimize distractions to fellow students.
- Ten-minute breaks are given between modules.
- Lunch is 1 hour.

TP-10

## Points to Remember

- Attendance is required in order to receive an EPA course completion certificate.
- The attendance sheet must be signed each morning and afternoon.
- Direct participation in case study exercises is expected.
- Each student must take the examination.

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## *About the Training Evaluation*

The *Training Evaluation* is a tool to collect valuable feedback from YOU about this course.

We value YOUR comments!! Important modifications have been made to this course based on comments from previous students.

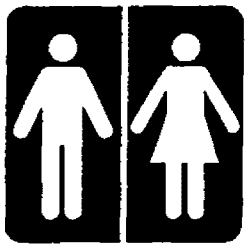
### DO

- Complete an evaluation at the end of each module!
- Tell us if you feel the content of the course manual is clear and complete!
- Tell us if you feel the activities and exercises were useful and helpful!
- Tell us if you feel the course will help you perform related duties back on the job!
- Complete the first page of the evaluation at the end of the course before you leave!
- Write comments in ink.

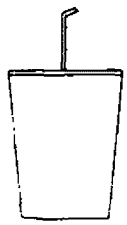
### DON'T

- Hold back!
- Focus exclusively on the presentation skills of the instructors.
- Write your name on the evaluation if it will inhibit you from being direct and honest.

## *Facility Information*



Please put beepers in the vibrate mode and turn off radios. Be courteous to fellow students and minimize distractions.



**Emergency Telephone Numbers**

**Emergency Exits**

**Alarms**

**Sirens**

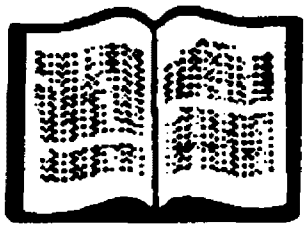
# SAFETY AND HEALTH COMPLIANCE WITH 29 CFR 1910.120

## Safety and Health Compliance with 29 CFR 1910.120

29 CFR 1926

40 CFR 311

29 CFR 1910



Executive Order 12196

55 FR 14072

59 FR 43268

NIOSH / OSHA / USCG / EPA

TP-1

## Safety and Health Compliance with 29 CFR 1910.120

Module Purpose:

- To distinguish the relationship between regulations, consensus standards, and guidance documents
- To identify the compliance areas of 29 CFR 1910.120

TP-2

## *Module Goals:*

The student goals for this module are:

1. Given the compliance terms "regulation," "consensus standard," and "guidance document," distinguish the relationships between them.

2. Given 29 CFR 1910.120, identify each of the paragraphs.

Given the following compliance terms, define them: standard, regulation, consensus standard, and guidance document.

## Definitions

| | |
|---|---|
| Standard: | "Any definite ____, principle, or measure established by authority." |
| Regulation: | A rule or order having the force of ___ issued by executive authority of a government. |
| Consensus Standard: | A standard adopted and _____ by a nationally recognized standards-producing organization and adopted by the Department of Labor. |
| Guidance Document: | Recommended or suggested rules, procedures, methods, etc., that are ___ _____ by law. |

**TP-3**

Given regulations, consensus standards, and guidance documents, interrelate the concepts by:

- Differentiating between legal requirements and tort liability.

## Relationship of Compliance Terms

| | |
|---|---|
| Legal Requirements | Regulations, standards, laws, etc., that an Environmental Health and Safety Manager "must" or "shall" address. |
| Tort Liability | Any wrongful act, damage, or injury done willfully, negligently, or in circumstances involving strict liability but not involving breach of contract for which a civil suit can be brought. |

TP-4

# Legal Requirements vs. Tort Liability

Legal Requirements

Tort Liability

TP-5

Given regulations, consensus standards, and guidance documents, interrelate the concepts by:

- Identifying the safety and health regulatory process.

## Safety and Health Regulatory Process

Groups affected by the
OSH Act of 1970 → Occupational Safety
and Health Administration (OSHA):

- Private industry
- Federal employees
- State plans

**TP-6**

# Safety and Health Regulatory Process

LEGAL REQUIREMENTS

REGULATIONS

---

CONSENSUS STANDARDS

GUIDANCE DOCUMENTS

TORT LIABILITY

**TP-7**

Given regulations, consensus standards, and guidance documents, interrelate the concepts by:

- Identifying the role of the following in safety and health decision-making:
  - Consensus standards
  - Guidance documents

## Nonregulatory Safety and Health Decision-making

LEGAL REQUIREMENTS

REGULATIONS

CONSENSUS STANDARDS

GUIDANCE DOCUMENTS

TORT LIABILITY

**TP-8**

Given 29 CFR 1910.120, list paragraph titles.

## HAZWOPER Historical Perspective

- Resource Conservation and Recovery Act (RCRA) (1976)
- Clean Water Act (1977)
- Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)/Superfund (1980)
- U.S. Environmental Protection Agency (EPA) Order 1440.2: "Health and Safety Requirements for Employees Engaged in Field Activities" (1981)
- EPA Standard Operating Safety Guides (SOSGs), Office of Solid Waste and Emergency Response (OSWER) (1981)
- NIOSH/OSHA/USCG/EPA Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (1985)

TP-9

## Superfund Amendments and Reauthorization Act (SARA) (1986)

Required both OSHA and EPA to develop health and safety regulations

Regulations must cover all employees engaged in hazardous waste operations and emergency response activities and provide no less protection than:

- EPA Order 1440.2
- 29 CFR 1926 (construction standards), Subpart C

TP-10

## Worker Protection Standards

OSHA: 29 CFR 1910.120

- OSHA specifically used the NIOSH/OSHA/USCG/EPA ("Interagency") manual as an outline in preparing the interim and final rule

EPA: 40 CFR 311

- Section 311.1 — Scope and Application
- Section 311.2 — Definition of Employee

TP-11

## Paragraph (a)
## Scope, Application, and Definitions

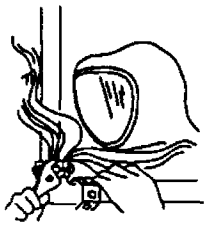
Scope

- Government cleanup operations
- Corrective actions under RCRA
- Voluntary cleanup operations
- TSD facility hazardous waste operations
- Emergency response operations

TP-12

## Paragraph (a) (cont.)
## Scope, Application, and Definitions

Application



- Cleanup operations:
  - Paragraphs (b) through (o)
- TSD facility hazardous waste operations:
  - Paragraph (p)
- Emergency response operations:
  - Paragraph (q)

TP-13

## Paragraphs (b), (c), and (d)

Paragraph (b) — Safety and Health Program

Paragraph (c) — Site Characterization and Analysis

Paragraph (d) — Site Control

**TP-14**

## Paragraphs (e), (f), (g), and (h)

Paragraph (e) — Training

Paragraph (f) — Medical Surveillance

Paragraph (g) — Engineering Controls, Work Practices, and Personal Protective Equipment

Paragraph (h) — Monitoring

**TP-15**

## Paragraphs (i), (j), (k), and (l)

Paragraph (i) — Informational Programs

Paragraph (j) — Handling Drums and Containers

Paragraph (k) — Decontamination

Paragraph (l) — Emergency Response by Employees at Uncontrolled Hazardous Waste Sites

**TP-16**

## Paragraphs (m), (n), and (o)

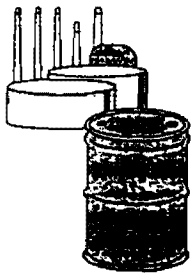
Paragraph (m)
Illumination

Paragraph (n)
Sanitation at Temporary Workplaces

Paragraph (o)
New Technology Programs

TP-17

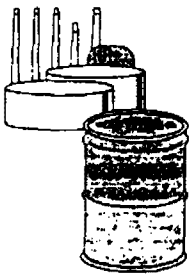
## Paragraph (p)
## Certain Operations Conducted Under the Resource Conservation and Recovery Act of 1976 (RCRA)



- Safety and health program
- Hazard communication program
- Medical surveillance program
- Decontamination program

TP-18

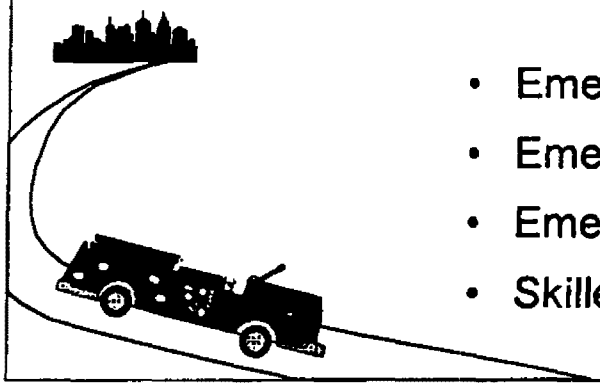
## Paragraph (p) (cont.)
## Certain Operations Conducted Under the Resource Conservation and Recovery Act of 1976 (RCRA)



- New technology program
- Material handling program
- Training program
- Emergency response plan

TP-19

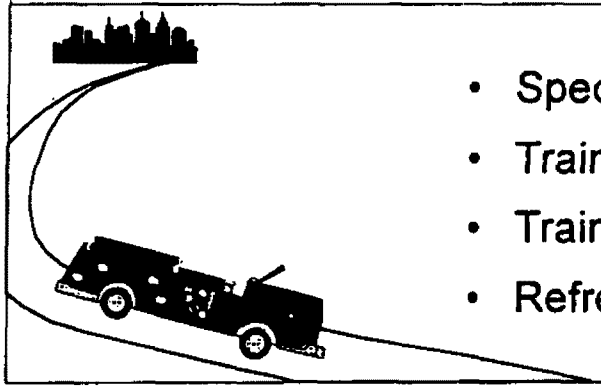
## Paragraph (q)
## Emergency Response to Hazardous Substances Releases



- Emergency response plan
- Emergency response plan elements
- Emergency response procedures
- Skilled support personnel

TP-20

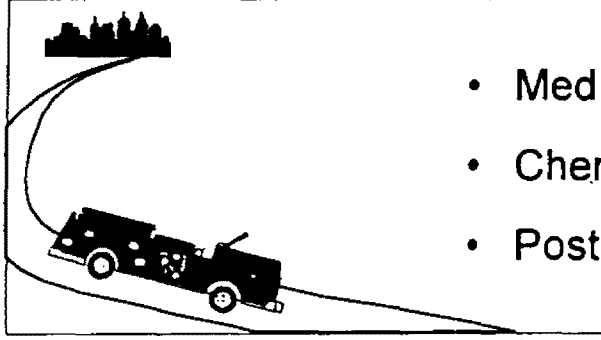
## Paragraph (q) (cont.)
## Emergency Response to Hazardous Substances Releases



- Specialist employees
- Training
- Trainers
- Refresher training

TP-21

## Paragraph (q) (cont.)
## Emergency Response to Hazardous Substances Releases



- Medical surveillance and consultation
- Chemical protective clothing
- Postemergency response operations

TP-22

## Federal Regulations

- OSHA – General Industry
- OSHA – Construction Standard
- Mine Safety and Health Administration
- National Contingency Plan
- Hazardous Materials Transportation

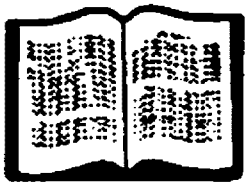
TP-23

## American National Standards Institute (ANSI)

- Z88.2 - 1992 – Practices for Respiratory Protection
- Z88.6 - 1994 – Physical Qualifications for Wearing Respiratory Protection

TP-24

## National Fire Protection Association (NFPA)



- NFPA - 1981 – Open-circuit Self-contained Breathing Apparatus
- NFPA - 1991 – Vapor Protective Suits for Hazardous Chemical Emergencies

TP-25

# Conclusion

- **Safety and Health Compliance with 29 CFR 1910.120**
- Safety and Health Construction Standards
- Toxic and Hazardous Substances Standards
- Safety and Health Program, Paragraph (b)

**TP-26**

## Crossword Puzzle

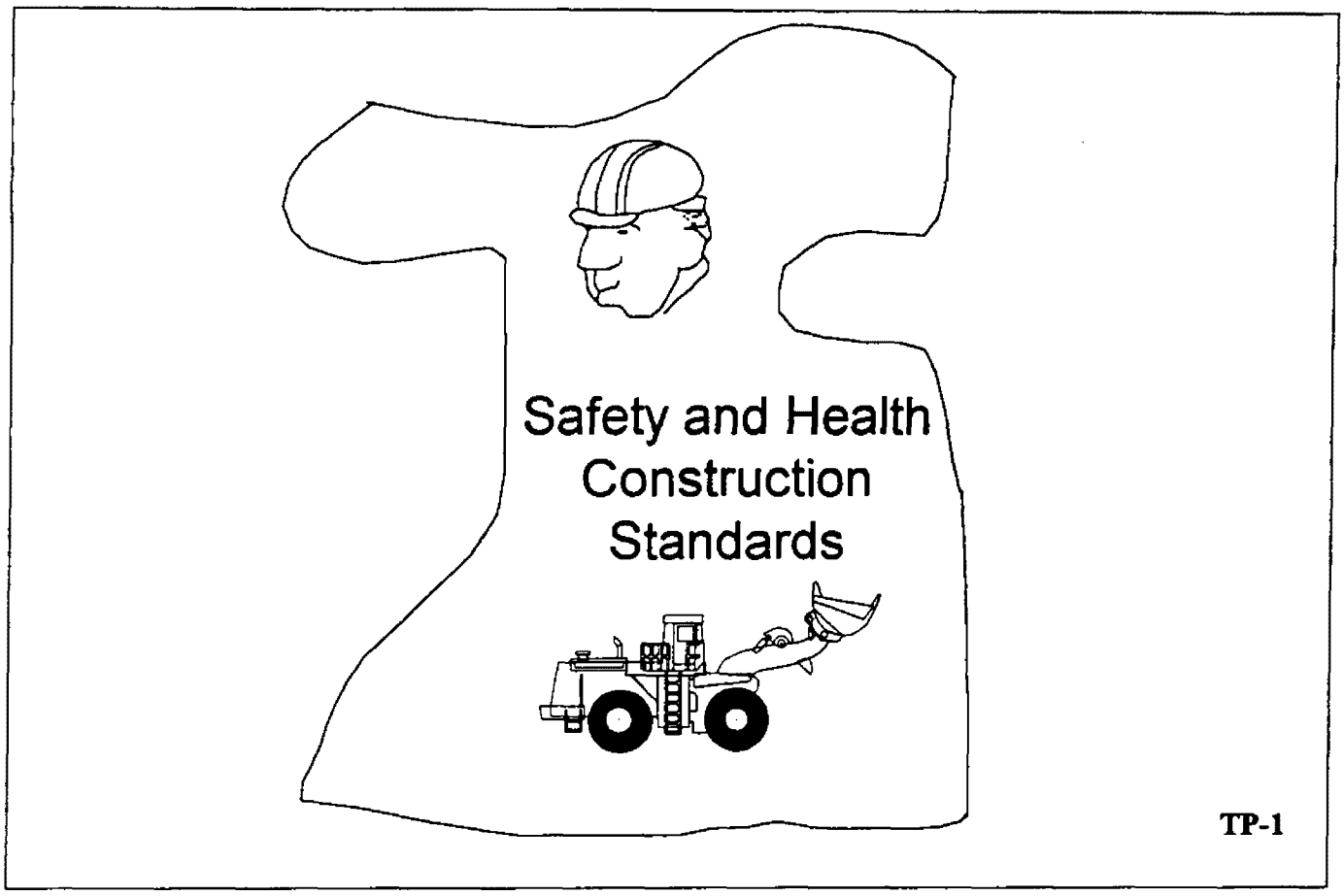
**Across**

17. "_____" liability
26. "_____" and safety plan
41. Consensus standard organization whose standards OSHA uses and/or refers to (acronym)

**Down**

3. A legal requirement that must be followed
29. 29 ____ 1910.120 (acronym)
30. Consensus standard organization specializing in fire protection and hazardous materials (acronym)
40. Federal agency that establishes worker protection standards (acronym)

# SAFETY AND HEALTH CONSTRUCTION STANDARDS




## *Module Goal:*

The student goal for this module is:

Given 29 CFR 1926 and a hazardous waste site description, identify the subparts and sections used to ensure worker health and safety at the site.

# 29 CFR 1926
# Safety and Health Regulations for Construction

SUBPART A — General

SUBPART B — General Interpretations

SUBPART C — General Safety and Health Provisions

**SUBPART D — Occupational Health and Environmental Controls**

**SUBPART E — Personal Protective and Life Saving Equipment**

SUBPART F — Fire Protection and Prevention

SUBPART G — Signs, Signals, and Barricades

SUBPART H — Materials Handling, Storage, Use, and Disposal

SUBPART I — Tools - Hand and Power

SUBPART J — Welding and Cutting

SUBPART K — Electrical

SUBPART L — Scaffolding

SUBPART M — Fall Protection

SUBPART N — Cranes, Derricks, Hoists, Elevators, and Conveyors

**SUBPART O — Motor Vehicles, Mechanized Equipment, and Marine Operations**

**SUBPART P — Excavations**

SUBPART Q — Concrete and Masonry Construction

SUBPART R — Steel Erection

SUBPART S — Underground Construction, Caissons, Cofferdams, and Compressed Air

SUBPART T — Demolition

SUBPART U — Blasting and Use of Explosives

SUBPART V — Power Transmission and Distribution

SUBPART W — Rollover Protective Structures; Overhead Protection

SUBPART X — Stairways and Ladders

SUBPART Y — Diving

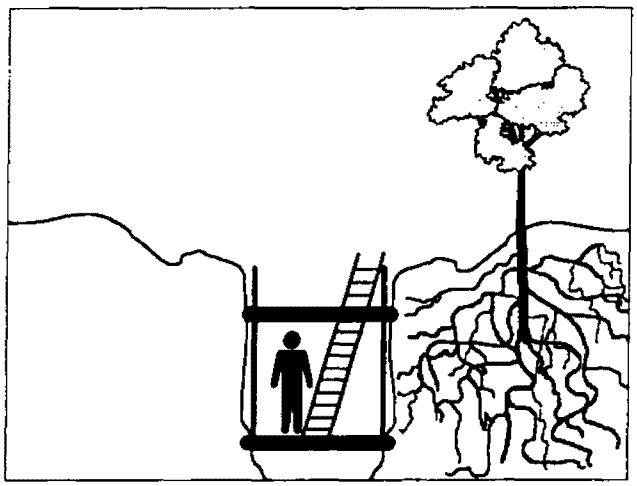
SUBPART Z — Toxic and Hazardous Substances

Given the subparts of 29 CFR 1926 and a job function performed on a hazardous waste site, list the sections of each subpart that apply to the job function.

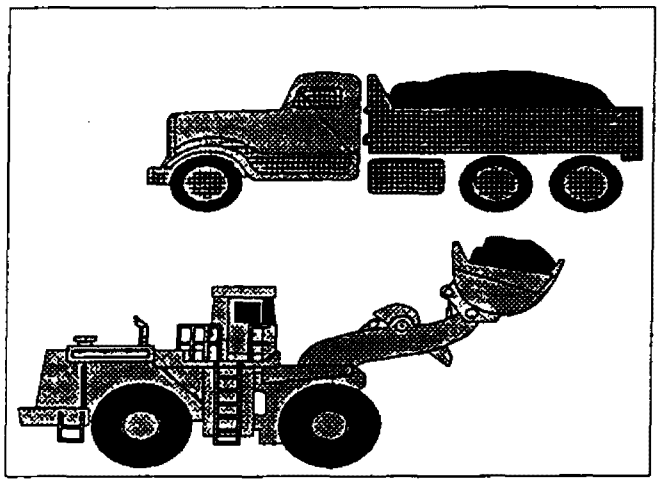
Given applicable subparts and sections of 29 CFR 1926 and a description of the construction work to be performed on a hazardous waste site, list the construction hazards that may be encountered.

Given applicable sections of 29 CFR 1926 and a hazardous waste site description, list the control measure(s) used to ensure worker health and safety.

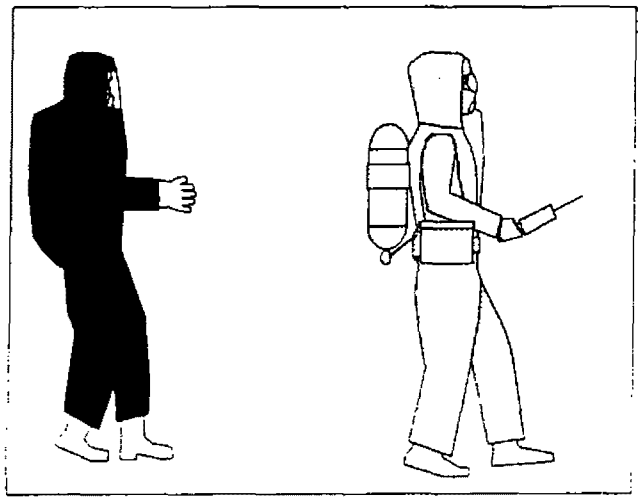
Subpart _____



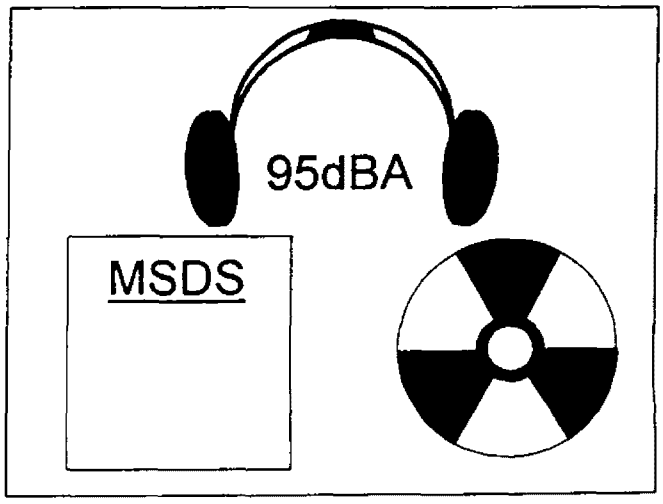
Subpart _____



Subpart _____



Subpart _____



## Subpart D — Occupational Health and Environmental Controls

- 1926.50 — Medical Services and First Aid
- 1926.51 — Sanitation
- 1926.52 — Occupational Noise Exposure
- 1926.53 — Ionizing Radiation
- 1926.54 — Nonionizing Radiation

TP-2

## Subpart D — Occupational Health and Environmental Controls (cont.)

- 1926.55 — Gases, Vapors, Fumes, Dusts, and Mists
- 1926.56 — Illumination
- 1926.57 — Ventilation
- 1926.59 — Hazard Communication

TP-3

## Subpart E — Personal Protective and Life Saving Equipment

- 1926.100 — Head Protection
- 1926.101 — Hearing Protection
- 1926.102 — Eye and Face Protection
- 1926.103 — Respiratory Protection

TP-4

## Subpart E — Personal Protective and Life Saving Equipment (cont.)

- 1926.104 — Safety Belts, Lifelines, and Lanyards
- 1926.105 — Safety Nets
- 1926.106 — Working Over or Near Water
- 1926.107 — Definitions Applicable to this Subpart

TP-5

## Head Protection

OSHA requires workers to wear head protection when a possible danger of head injury exists from:

- Impact with a fixed object.
- Falling or flying objects.
- Electrical shock and burns.

TP-6

## Hard Hat Chart

| Class | Use | Work Function |
|---|---|---|
| A | General service, limited voltage | General construction |
| B | Utility service, high voltage | Electrical workers |
| C | Special service, no voltage (metal) | Oil fields, refineries |

TP-7

# Eye and Face Protection

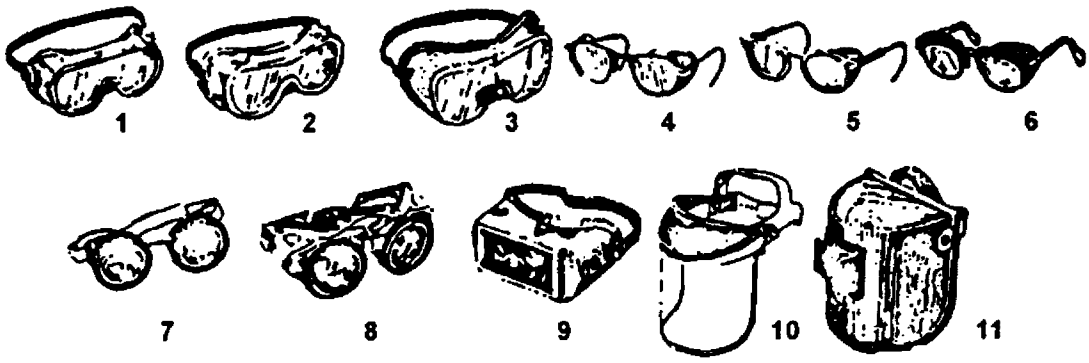
OSHA requires that workers be provided with eye and face protection equipment when machines or operations present potential eye or face injury from physical, chemical, or radiation agents.

*Source:* 29 CFR 1926.102(a)(1)

**TP-8**

# Table E-1
# Eye and Face Protector Selection Guide

| Operation | Hazards | Recommended Protectors: (see below) |
|---|---|---|
| Acetylene-burning | Sparks, harmful rays, molten metal, flying particles | 7, 8, 9 |
| Acetylene-cutting | Sparks, harmful rays, molten metal, flying particles | 7, 8, 9 |
| Acetylene-welding | Sparks, harmful rays, molten metal, flying particles | 7, 8, 9 |
| Chemical handling | Splash, acid burns, fumes | 2, 10 (for severe exposure add 10 over 2) |
| Chipping | Flying particles | 1, 3, 4, 5, 6, 7A, 8A |
| Electric (arc) welding | Sparks, intense rays, molten metal | 9, 11 (11 in combination with 4, 5, 6 in tinted lenses advisable) |
| Furnace operations | Glare, heat, molten metal | 7, 8, 9 (for severe exposure add 10) |
| Grinding-light | Flying particles | 1, 3, 4, 5, 6, 10 |
| Grinding-heavy | Flying particles | 1, 3, 7A, 8A (for severe exposure add 10) |
| Laboratory | Chemical splash, glass | 2 (10 when in combination with 4, 5, 6) |
| Machining | Flying particles | 1, 3, 4, 5, 6, 10 |
| Molten metals | Heat, glare, sparks, splash | 7, 8 (10 in combination with 4, 5, 6 in tinted lenses) |
| Spot welding | Flying particles, sparks | 1, 3, 4, 5, 6, 10 |




1. GOGGLES, Flexible Fitting, Regular Ventilation
2. GOGGLES, Flexible Fitting, Hooded Ventilation
3. GOGGLES, Cushioned Fitting, Rigid Body
*4. SPECTACLES, Metal Frame, with Sideshields
*5. SPECTACLES, Plastic Frame, with Sideshields
*6. SPECTACLES, Metal-Plastic Frame, with Sideshields
**7. WELDING GOGGLES, Eyecup Type, Tinted Lenses (Illustrated)
7A. CHIPPING GOGGLES, Eyecup Type, Clear Safety Lenses (Not Illustrated)
**8. WELDING GOGGLES, Coverspec Type, Tinted Lenses (Illustrated)
8A. CHIPPING GOGGLES, Coverspec Type, Clear Safety Lenses (Not Illustr.)
**9. WELDING GOGGLES, Coverspec Type, Tinted Plate Lens
10. FACE SHIELD (Available with Plastic or Mesh Window)
**11. WELDING HELMETS

* Non-side shield spectacles are available for limited hazard use requiring only frontal protection.

** See Table E-2, in paragraph (b) of this section, Filter Lens Shade Numbers for Protection Against Radiant Energy.

**Scenario:** A worker is doing light grinding on a weld on an incinerator.

1. What section(s) of Subpart E must be complied with?

   _____

2. What specific control measure is required by the section(s) identified in question 2?

   _____

   _____

**Scenario:** A worker is using an acetylene torch to cut a 6-in. pipe that will be used in a vapor extraction unit.

1. What section(s) of Subpart E must be complied with?

   _____

2. What specific control measure is required by the section(s) identified in question 2?

   _____

   _____

**Scenario:** A worker is assisting a crane operator to lower a component of a treatment process. The individual is using a guide rope to position the component. There is no potential for the worker to come into contact with high voltage.

1. What section(s) of Subpart E must be complied with?

   _____

2. Using the Hard Hat Chart, what class of head protection should be used by the worker?
   ____ Class A or ____ Class C

## Hearing Protection

OSHA states that wherever it is not feasible to reduce the noise levels or duration of permissible noise exposures as specified in 1926.52, Table D-2, ear protective devices shall be provided.

*Source:* 29 CFR 1926.101(a)

**TP-9**

## Types of Hearing Protection

Aural (inserts)

Superaural (hearing bands)

Circumaural (earmuffs)

**TP-10**

## Table D-2
## Permissible Noise Exposures

| Duration Per Day (Hours) | Sound Level (dBA) Slow Response |
|---|---|
| 8 | 90 |
| 6 | 92 |
| 4 | 95 |
| 3 | 97 |
| 2 | 100 |
| 1.5 | 102 |
| 1 | 105 |
| 0.5 | 110 |

*Source*: 29 CFR 1926.52

**TP-11**

## Selection of Hearing Protection

- Noise reduction rating (NRR)
- Worker comfort

| Noise exposure without hearing protection | | NRR of hearing protection | | Noise exposure with hearing protection |
|---|---|---|---|---|
| 100 dBA* | – | 25 dB | = | 75 dBA |

*dBA = Decibels measured on the A-weighted scale

**TP-12**

# Personal Protective Equipment Sections Not Discussed

- 1926.103 — Respiratory Protection
- 1926.104 — Safety Belts, Lifelines, and Lanyards
- 1926.105 — Safety Nets
- 1926.106 — Working Over or Near Water

TP-13

# Subpart O — Motor Vehicles, Mechanized Equipment, and Marine Operations

- 1926.600 — Equipment
- 1926.601 — Motor Vehicles
- 1926.602 — Material Handling Equipment
- 1926.603 — Pile Driving Equipment
- 1926.604 — Site Clearing
- 1926.605 — Marine Operations

**TP-14**

## Subpart P — Excavations

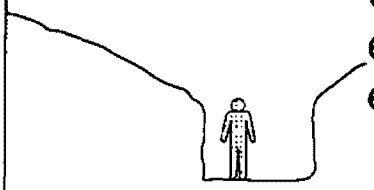
- 1926.650 — Scope, Application, and Definitions
- 1926.651 — General Requirements
- 1926.652 — Requirement for Protective Systems

TP-15

**Shoring**: A structure that supports the sides of an excavation and which is designed to prevent cave-ins.

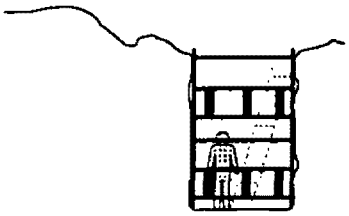
**TP-16**

**Sloping**: A method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins.



**TP-17**

**Shielding**: A structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure.



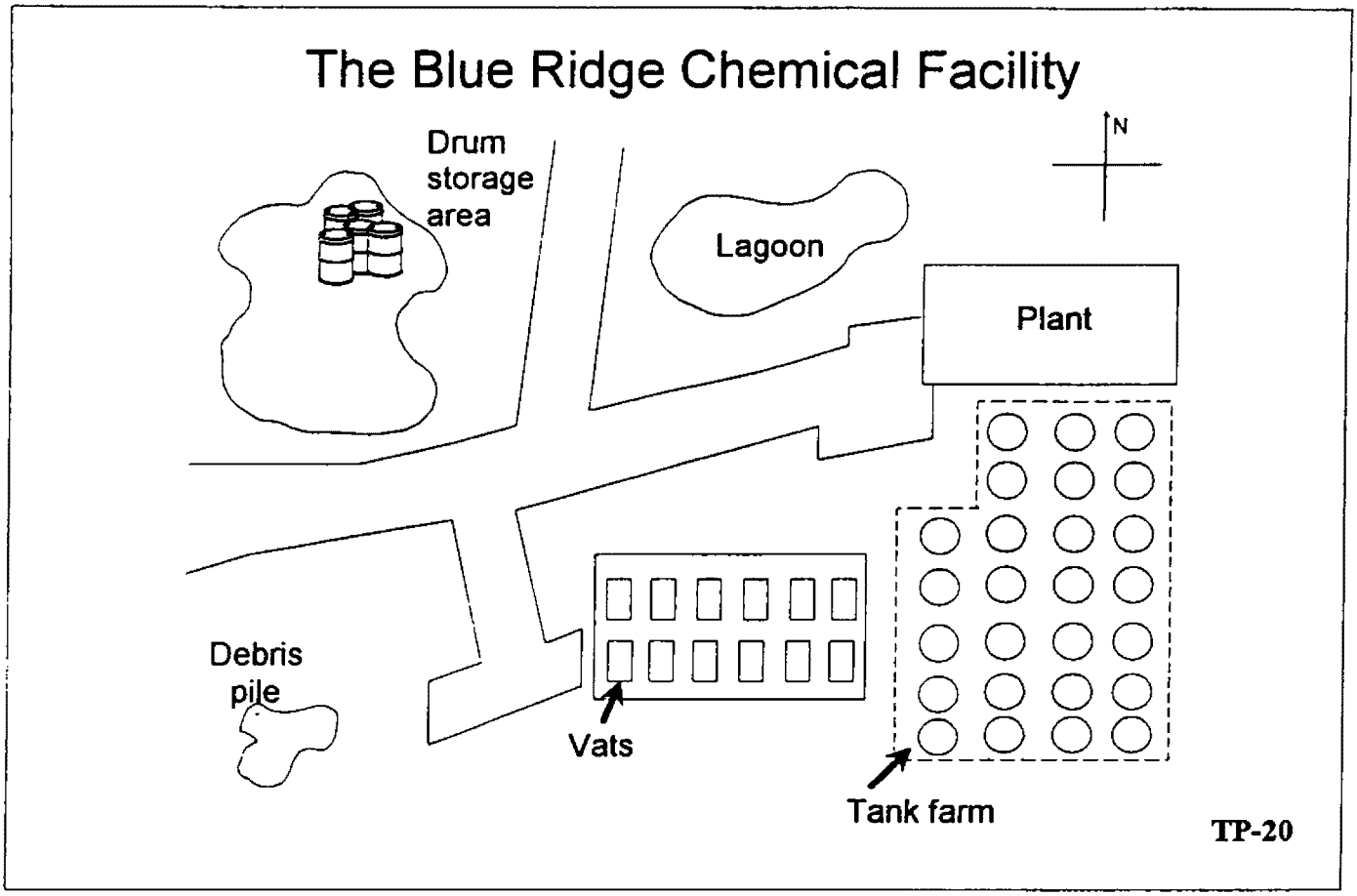
**TP-18**

Excavations shall be protected from cave-ins, unless the excavation is in stable rock or is less than five feet in depth and has been examined by a competent person to indicate that there is no potential of a cave-in.

*Source:* 29 CFR 1926.652(a)(1)

**TP-19**

## Notes:




**Site description:** The site is an abandoned chemical plant located in a rural east coast area. The area is residential, with a few industries located within the city limits. The facility manufactured specialty chemicals. Most of the process lines still have product in them. There are approximately 300 drums, 50 vertical tanks, 14 vats, and 1 lagoon onsite. The following construction activities are taking place on the site. Please identify which subpart and section of 29 CFR 1926 applies to each activity:

1. Workers using mechanized equipment are loading dumpsters with debris from the pile in the southwest corner of the site. _____

2. A drum grappler is being used to lower drums that are stacked two and three high in the drum storage area. _____

3. A temporary electric line needs to be extended from the power line on the east side to the mobile lab on the west side. _____

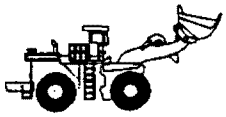
4. A worker is using a jackhammer to break cement near the vats. The noise level has been measured and is approximately 96 dBA. The task should take 6 hours to complete.

5. A backhoe is being used to remove the top layer of contaminated soil from the drum storage area.

For scenarios 1–5, one subpart and section is directly applicable. For scenario 6, identify all of the subparts and sections that apply.

6. A work crew is using a backhoe to reach a 10-ft-long chemical transfer pipe located 5 ft below the surface. The excavation will be in loose soil and not in rock or clay. The pipe will need to be cut using a torch.

| Name of Standard | Subpart | Section |
|---|---|---|
| Material Handling | | |
| Excavation | | |
| Cutting | | |
| Eye and Face Protection | | |
| Exposure to Chemicals | | |
| Head Protection | | |



# Conclusion

- Safety and Health Compliance with 29 CFR 1910.120
- **Safety and Health Construction Standards**
- Toxic and Hazardous Substances Standards
- Safety and Health Program, Paragraph (b)

**TP-21**

## Crossword Puzzle

**Across**

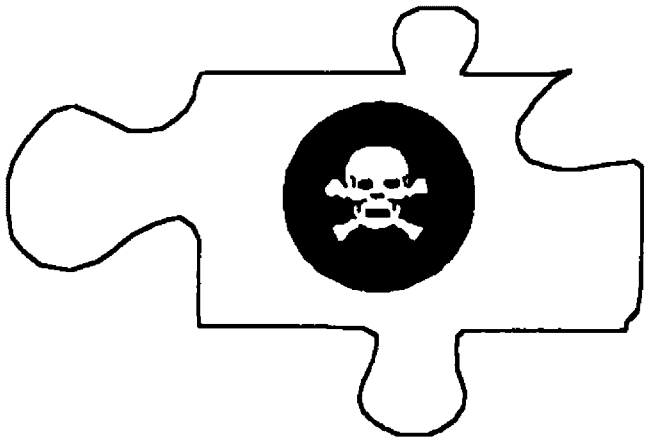
27. Unit of measure for sound (abbreviation)
33. Job function requiring a Class B hard hat
42. Inhalation hazard sometimes associated with demolition

**Down**

19. Metal structure designed to protect workers in an excavation from a cave-in

# TOXIC AND HAZARDOUS SUBSTANCES STANDARDS

## Toxic and Hazardous Substances Standards



TP-1

## Toxic and Hazardous Substances Standards

Module Goal: Determine which sections of the Toxic and Hazardous Substances standards (29 CFR 1910, Subpart Z) are applicable to hazardous waste operations and emergency response.

TP-2

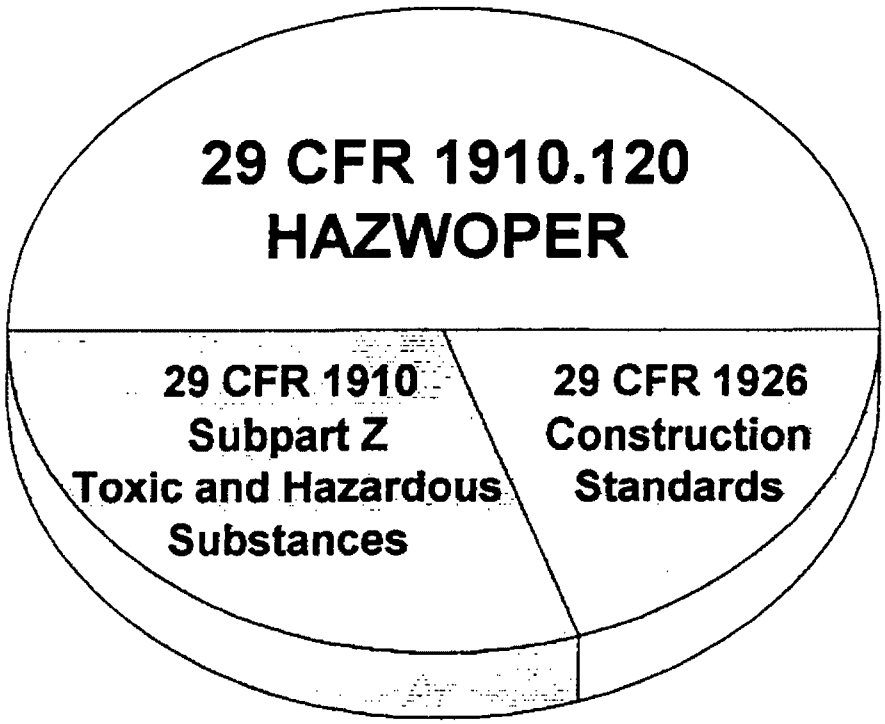
## *Module Goal:*

The student goal for this module is:

Given 29 CFR, Part 1910 and a hazardous waste site, determine which sections of the Toxic and Hazardous Substances standards (29 CFR 1910, Subpart Z) are applicable to hazardous waste operations and emergency response.

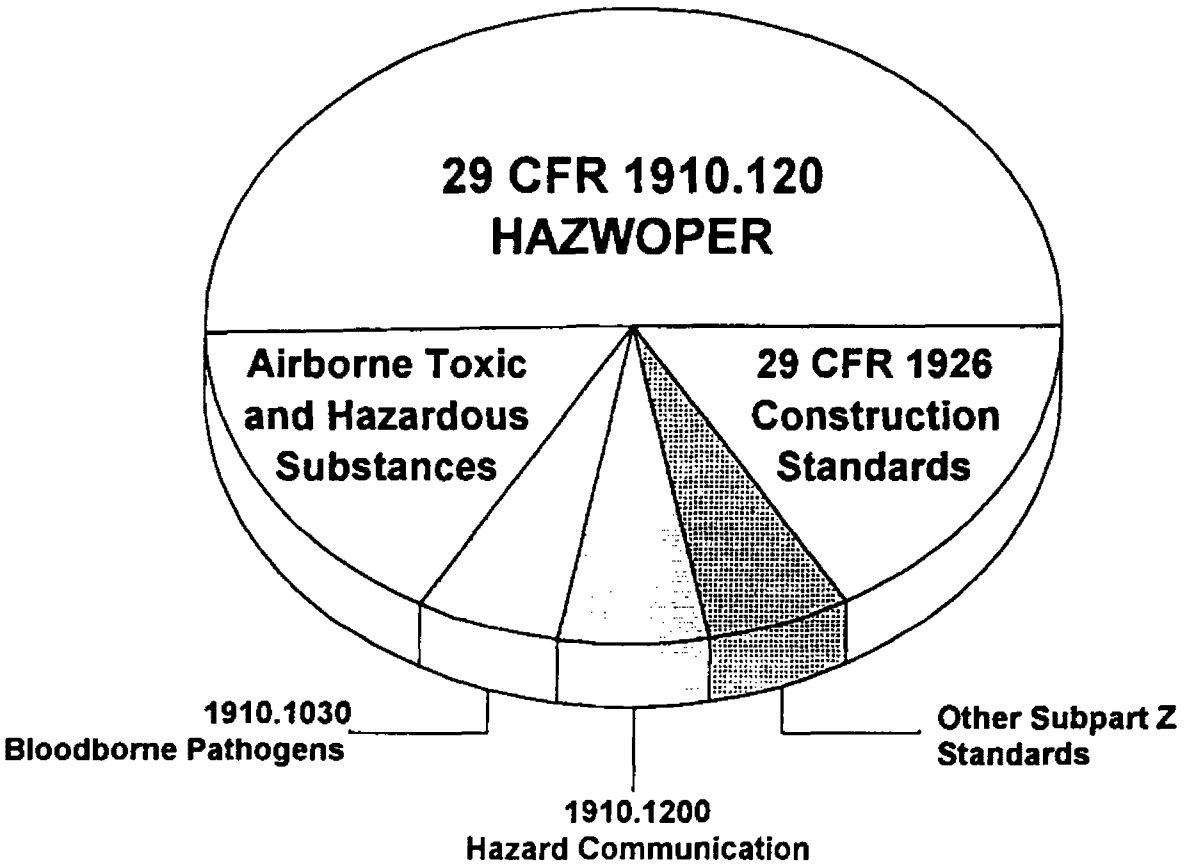
Given 1910 Subpart Z, identify the Toxic and Hazardous Substances standards applicable to hazardous waste operations and emergency response activities.

## OSHA Standards Applicable to Hazardous Waste Operations and Emergency Response




TP-3

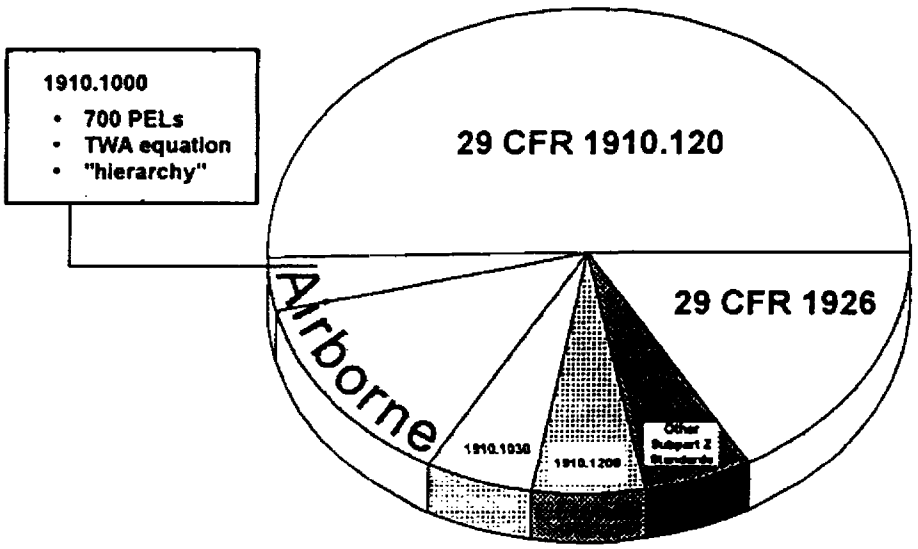
# OSHA Subpart Z Standards Applicable to Hazardous Waste Operations and Emergency Response




TP-4

Given 1910 Subpart Z, identify the requirements in the standards applicable to worker exposure to airborne concentrations of toxic and hazardous substances.

# Subpart Z Standards Applicable to Hazardous Waste Operations and Emergency Response




TP-5

Given 1910 Subpart Z and the requirements in the standards applicable to worker exposure to airborne concentrations of toxic and hazardous substances:

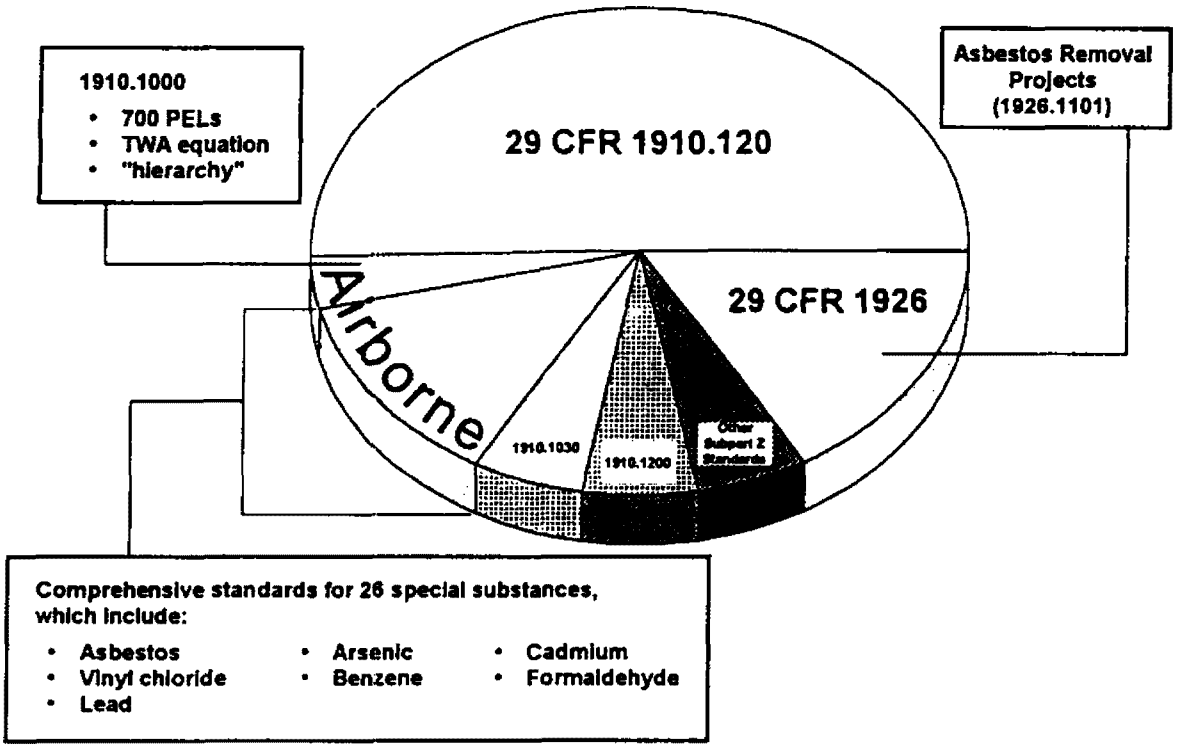
- Identify, in the order required by OSHA, the methods that must be used to control worker exposure to airborne concentrations of toxic and hazardous substances.

## 1910.1000(e)

- Hierarchy of controls: Implement feasible engineering or administrative controls before relying on personal protective equipment (PPE) to control exposure.
- Strategy approved by an industrial hygienist or other technically qualified person.
- Use of respirators must comply with 1910.134.

TP-6

# Subpart Z Standards Applicable to Hazardous Waste Operations and Emergency Response



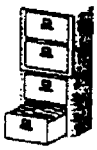
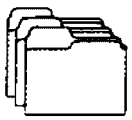

TP-7

Given 1910 Subpart Z and the requirements in the standards applicable to worker exposure to airborne concentrations of toxic and hazardous substances:

- Identify the additional types of requirements in the standards established by OSHA covering exposure to 26 specific substances.

## Substance-specific Standards

- Action levels
- Exposure monitoring
- Regulated area
- Respiratory protection
- Protective clothing and equipment
- Hygiene and housekeeping
- Medical surveillance and removal
- Communication of hazards
- Recordkeeping
- Appendices

TP-8–10

## Exercise #1

### EXPOSURE MONITORING REQUIREMENTS FROM OSHA CADMIUM STANDARD

Determinations of employee exposure shall be made from breathing zone air samples that reflect the monitored employee's regular, daily 8-hour TWA exposure to cadmium.

Eight-hour TWA exposures shall be determined for each employee on the basis of one or more personal breathing zone air samples reflecting full shift exposure on each shift, for each job classification, in each work area. Where several employees perform the same job tasks, in the same job classification, on the same shift, in the same work area, and the length, duration, and level of cadmium exposures are similar, an employer may sample a representative fraction of the employees in order to meet this requirement. In representative sampling, the employer shall sample the employee(s) expected to have the highest cadmium exposures.

*Source:* 29 CFR 1910.1027(d)(1)(ii–iii)

## Exercise #2

**TABLE 2 — RESPIRATORY PROTECTION FOR CADMIUM**

| Airborne concentration or condition of use[a] | Required respirator type[b] |
|---|---|
| 10 × or less | A half mask, air-purifying respirator equipped with a HEPA[c] filter[d]. |
| 25 × or less | A powered air-purifying respirator ("PAPR") with a loose-fitting hood or helmet equipped with a HEPA filter, or a supplied-air respirator with a loose-fitting hood or helmet face piece operated in the continuous flow mode. |
| 50 × or less | A full face piece air-purifying respirator equipped with a HEPA filter, or a powered air-purifying respirator with a tight-fitting half mask equipped with a HEPA filter, or a supplied-air respirator with a tight-fitting half mask operated in the continuous flow mode. |
| 250 × or less | A powered air-purifying respirator with a tight-fitting full face piece equipped with a HEPA filter, or a supplied-air respirator with a tight-fitting full face piece operated in the continuous flow mode. |
| 1000 × or less | A supplied-air respirator with half mask or full face piece operated in the pressure demand or other positive pressure mode. |
| >1000 × or unknown concentrations | A self-contained breathing apparatus with a full face piece operated in the pressure demand or other positive pressure mode, or a supplied-air respirator with a full face piece operated in the pressure demand or other positive pressure mode and equipped with an auxiliary escape-type self-contained breathing apparatus operated in the pressure demand mode. |
| Fire fighting | A self-contained breathing apparatus with full face piece operated in the pressure demand or other positive pressure mode. |

[a] Concentrations expressed as multiple of the PEL.

[b] Respirators assigned for higher environmental concentrations may be used at lower exposure levels. Quantitative fit testing is required for all tight-fitting air-purifying respirators where airborne concentration of cadmium exceeds 10 times the TWA PEL ($10 \times 5\ \mu g/m^3 = 50\ \mu g/m^3$). A full face piece respirator is required when eye irritation is experienced.

[c] HEPA means high efficiency particulate air.

[d] Fit testing, qualitative or quantitative, is required.

*Source:* 29 CFR 1910.1027 (g)(2)(i). Table 2 was compiled with information from the Respirator Decision Logic document (U.S. DHHS 1987).

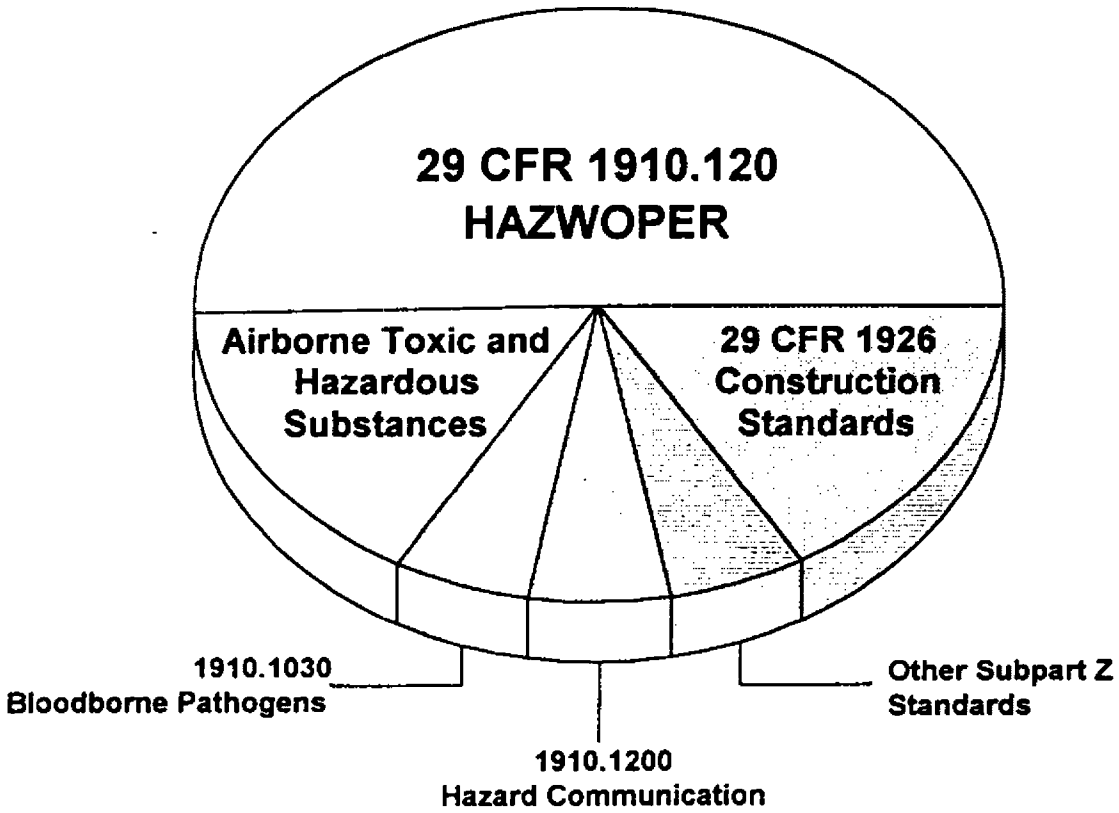
**The PEL-TWA for cadmium is 5 $\mu g/m^3$. Initial monitoring indicates that the exposure of a bull-dozer operator loading cadmium-contaminated soils into a dump truck during a 430-minute work shift was 48 $\mu g/m^3$.**

1. Using Table 2 from the OSHA cadmium standard (above), which respirator would be required to control this exposure? Assume that no feasible engineering, work practice, or administrative controls can be implemented. _____
   How would EPA guidelines impact your selection of the respirator? _____
   _____

2. Would quantitative fit testing of the respirator be required? YES NO
   Why or why not? _____
   _____
   _____

Given 1910 Subpart Z, identify the requirements of the Bloodborne Pathogens standard.

# Subpart Z Standards Applicable to Hazardous Waste Operations and Emergency Response




TP-11

# Bloodborne Pathogens Standard 1910.1030

- Exposure control
- Methods of compliance
- Research/production facilities
- Medical surveillance
- Communication of hazards
- Recordkeeping

TP-12

# Bloodborne Pathogens Standard 1910.1030 (cont.)

HAZWOPER employees may be covered by OSHA's Bloodborne Pathogens standard primarily during three field situations:

- Cleanup of a hazardous waste site containing infectious waste
- Operation of an infectious waste incinerator
- Infectious waste spill

**TP-13**

# Bloodborne Pathogens Standard 1910.1030 (cont.)

**1910.1030 ⟸ vs. ⟹ 1910.120**

Exposure Control
- Exposure Control Plan
- Exposure determination

Safety and Health Program
- Health and safety plan
- Hazard/risk analysis by task

PPE
- Dermal
- Mouthpieces for CPR
- Eye/face shields
- Gloves

PPE
- Levels A, B, C

TP-14

# Bloodborne Pathogens Standard 1910.1030 (cont.)

**1910.1030** ⟸ **vs.** ⟹ **1910.120**

Medical Surveillance
- HBV vaccination
- Specific postexposure incident evaluation and follow-up
- Information for/from healthcare professional
- Records

Medical Surveillance
- Baseline, annual, termination examinations
- Content determined by attending physician
- Information for/from physician
- Records

**TP-15**

# Bloodborne Pathogens Standard 1910.1030 (cont.)

| 1910.1030 | ⟸ vs. ⟹ | 1910.120 |
|---|---|---|
| Training | | Training |

TP-16

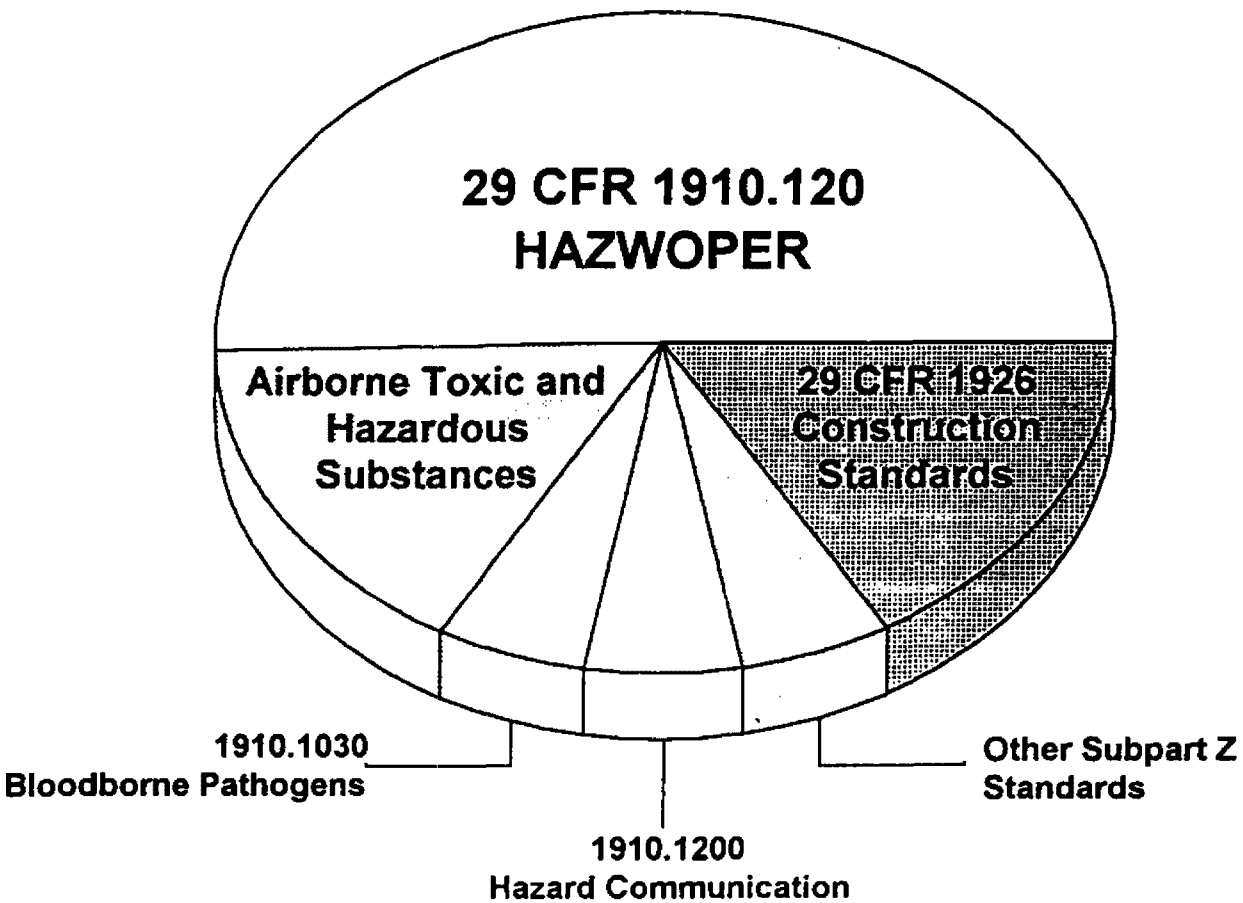
**Minimum Training Requirements of the Bloodborne Pathogens Standard**

- Explanation of the standard.
- Epidemiology and symptoms of bloodborne diseases.
- Modes of transmission of bloodborne pathogens.
- Employer's control plan and means by which the employee can get a copy.
- Appropriate methods for recognizing tasks and other activities that may involve exposure.
- Use and limitations of methods to prevent or reduce exposure.
- Types, proper use, location, removal, handling, decontamination, and disposal of PPE.
- The basis for selection of PPE.
- Information on the HBV vaccine.
- Appropriate actions to take and persons to be contacted in an emergency.
- Procedures to follow if exposure occurs.
- Explanation of the signs, labels, and/or color-coding required by the standard.
- Opportunity for interactive questions and answers with the person conducting the training session.

*Source:* 29 CFR 1910.1030(g)(2) Information and Training

Given 1910 Subpart Z, identify the requirements of the Hazard Communication standard.

# Subpart Z Standards Applicable to Hazardous Waste Operations and Emergency Response




TP-17

# Hazard Communication Standard 1910.1200

- Purpose
- Scope and application
- Hazard determination
- Written hazard communication program

**TP-18**

**Minimum Content Requirements for a Hazard Communication Program**

- A description of labeling or other forms of warning that will be used on containers of hazardous chemicals.
- The procedures for obtaining and evaluating MSDS for each hazardous chemical used.
- A description of the employee information and training program.
- A list of the hazardous chemicals present at each workplace or individual work area.
- The methods for informing employees and volunteers of the hazards of nonroutine tasks.
- The methods the employer will use to communicate hazards to the employees of other employers at multiemployer work sites (e.g., hazardous waste sites).

# Hazard Communication Standard 1910.1200 (cont.)

- Labels and other forms of warning
- Material safety data sheets (MSDS)

**TP-19**

**Minimum Content Requirements for MSDS**

- Chemical and common name of hazardous chemicals.
- Identification of all carcinogens present in a concentration ≥0.1%.
- Identification of all hazardous chemicals present in a concentration ≥1%.
- Physical and chemical properties.
- Physical hazards (fire, explosion, reactivity).
- Health hazards (signs/symptoms).
- Primary routes of entry.
- Exposure limits (PEL, TLV, other).
- Safe handling and use procedures.
- Spill/leak cleanup procedures.
- Control measures (engineering, work practice, or PPE).
- Emergency first aid procedures.
- Date of preparation of the MSDS.
- Name, address, and emergency phone number of manufacturer, importer, or distributor.
- Determination of whether the chemical/material is considered a carcinogen.

# Hazard Communication Standard 1910.1200 (cont.)

- Employee information and training
- Trade secrets
- Effective dates:
  - Chemical manufacturers = 09/23/87
  - Nonmanufacturers = 05/23/88

**TP-20**

**Employee Information and Training Requirements**

- When?
  - Prior to initial assignment to area where hazardous chemicals are present.
  - Whenever a new hazard is introduced into the work area.
  - Whenever any operations occur in a work area where hazardous chemicals are present.
- Must include:
  - The availability and location of the written hazard communication program.
  - Required list(s) of hazardous chemicals and MSDS.
  - The physical and health hazards of the chemicals in the work area.
  - Methods and observations that may be used to determine the presence or release of hazardous substances in the work area.
  - Measures and/or procedures implemented to reduce or prevent exposure to hazards.
  - An explanation of the labeling system and MSDS.

## *HAZARD! a Guess*

| STANDARDS | AIR CONTAMINANTS | BLOODBORNE PATHOGENS | HAZARD COMMUNICATION | WILDCARD |
|---|---|---|---|---|
| $100 | $100 | $100 | $100 | $100 |
| $200 | $200 | $200 | $200 | $200 |
| $300 | $300 | $300 | $300 | $300 |
| $400 | $400 | $400 | $400 | $400 |

**Rules of *HAZARD! a Guess*:**

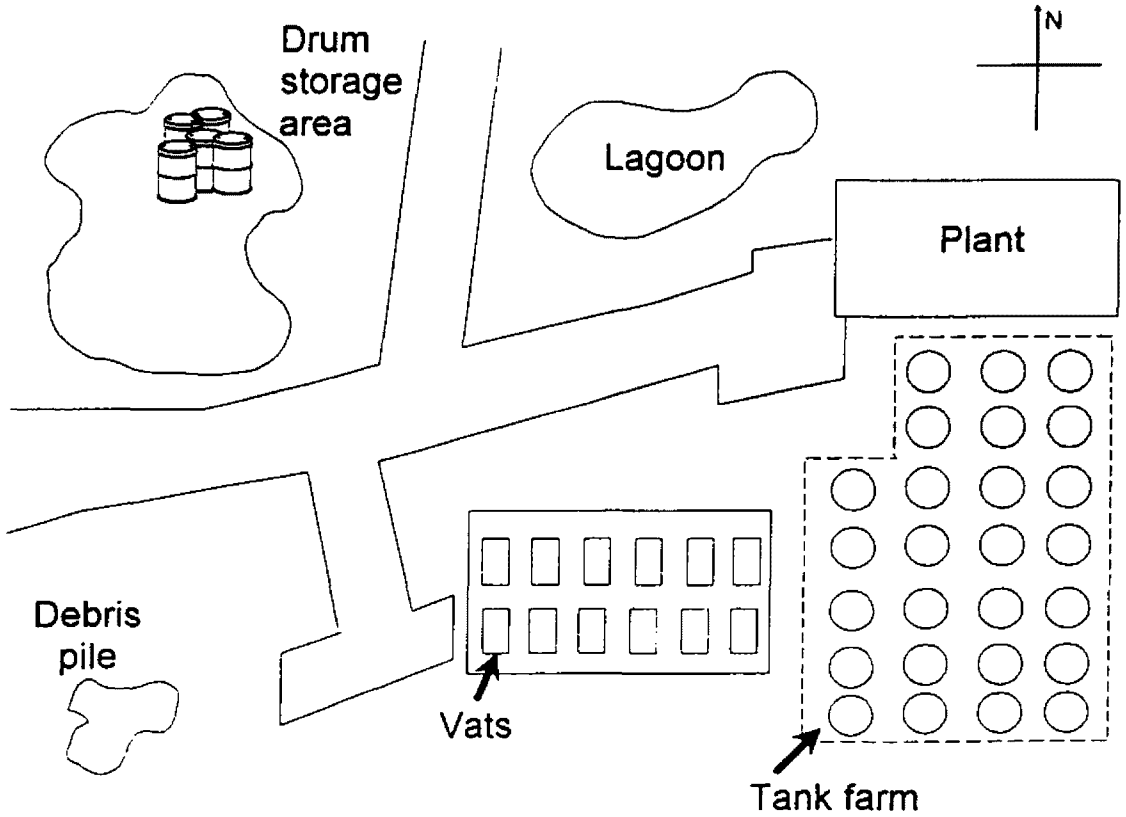
1. Group selects category and amount.
2. The Wildcard category includes anything that was discussed in this module.
3. Instructor reads clue.
4. First group to respond with the given sound device answers in the form of a question.
5. Failure to answer in the form of a question: Forfeit turn but no loss of points.
6. Group that provides correct answer chooses next category and amount.
7. *Visual Double HAZARD!:* Group can wager up to twice the value of the *Double HAZARD!*
8. *Terminal HAZARD!:* Group can wager up to accumulated total dollars.
9. Group with most points wins *HAZARD! a Guess*.
10. Group that wins *HAZARD! a Guess* is awarded 10 course points.

# Preliminary Assessment Report to the U.S. EPA on the Blue Ridge Chemical Facility

## Halliburton NUS Corporation
## January 1996

TP-21

## The Blue Ridge Chemical Facility




TP-22

## APPENDIX A — NIOSH POTENTIAL OCCUPATIONAL CARCINOGENS

The National Institute for Occupational Safety and Health (NIOSH) has identified numerous substances that should be treated as potential occupational carcinogens even though OSHA may not have identified them as such. In determining their carcinogenicity, NIOSH uses the OSHA classification outlined in 29 CFR 1990.103, which states in part:

> Potential occupational carcinogen means any substance, or combination or mixture of substances, which causes an increased incidence of benign and/or malignant neoplasms, or a substantial decrease in the latency period between exposure and onset of neoplasms in humans or in one or more experimental mammalian species as the result of any oral, respiratory or dermal exposure, or any other exposure which results in the induction of tumors at a site other than the site of administration. This definition also includes any substance which is metabolized into one or more potential occupational carcinogens by mammals.

NIOSH has not identified thresholds for carcinogens that will protect 100% of the population. NIOSH usually recommends that ***occupational exposures to carcinogens be limited to the lowest feasible concentration***. To ensure maximum protection from carcinogens through the use of respiratory protection, only the most reliable and protective respirators are recommended. These include (1) a self-contained breathing apparatus (SCBA) that has a full facepiece and is operated in a positive-pressure mode, or (2) a supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in a pressure-demand or other positive-pressure mode.

## APPENDIX C — SUPPLEMENTARY EXPOSURE LIMITS

**Asbestos**

NIOSH considers asbestos (i.e., actinolite, amosite, anthophyllite, chrysotile, crocidolite, and tremolite) to be a potential occupational carcinogen and recommends that exposures be reduced to the lowest possible concentration. For asbestos fibers >5 micrometers in length, NIOSH recommends a REL of 100,000 fibers per cubic meter of air (100,000 fibers/$m^3$), which is equal to 0.1 fiber per cubic centimeter of air (0.1 fiber/$cm^3$), as determined by a 400-liter air sample collected over 100 minutes and NIOSH Analytical Method #7400.

As found in 29 CFR 1910.1001, the OSHA PEL for asbestos fibers (i.e., actinolite asbestos, amosite asbestos, anthophyllite, chrysotile, crocidolite, and tremolite asbestos) is an 8-hour TWA airborne concentration of 0.1 fiber (longer than 5 micrometers and having a length-to-diameter ratio of at least 3 to 1) per cubic centimeter of air (0.1 fiber/$cm^3$), as determined by the membrane filter method at approximately 400× magnification with phase contrast illumination. No worker should be exposed in excess of 1 fiber/$cm^3$ (excursion limit) as averaged over a sampling period of 30 minutes.

As found in 29 CFR 1910.1101, the OSHA PEL for asbestos is an 8-hour TWA airborne concentration of 2 fibers (longer than 5 micrometers and having a length-to-diameter ratio of at least 3 to 1) per cubic centimeter of air (2 fibers/$cm^3$) as determined by the membrane filter method at 400–450× magnification (4-millimeter objective) with phase contrast illumination. This standard applies in lieu of the revised standards governing occupational exposure to asbestos (as defined in 1910.1001) and the non-fibrous forms of tremolite, anthophyllite, and actinolite during the period and to the extent that the revised standards have been partially stayed.

| Chemical name, structure/ formula, CAS and RTECS Nos., and DOT ID and guide Nos. | Synonyms, trade names, and conversion factors | Exposure limits (TWA unless noted otherwise) | IDLH | Physical description | Chemical and physical properties: MW, BP, SOL, Fl.P, IP, Sp.Gr, flammability | Chemical and physical properties: VP, FRZ, UEL, LEL | Incompatibilities and reactivities | Measurement method (See Table 1) |
|---|---|---|---|---|---|---|---|---|
| Asbestos<br><br>Hydrated mineral silicates<br><br>1332-21-4<br>C18475000<br><br>2212 31 (blue)<br>2590 31 (white) | Actinolite,<br>Actinolite asbestos<br>Amosite (cummingtonite-grunerite),<br>Anthophyllite<br>Anthophyllite asbestos<br>Chrysotile,<br>Crocidolite (Riebeckite),<br>Tremolite<br>Tremolite asbestos | NIOSH<br>Ca<br>See Appendix A<br>See Appendix C<br><br>OSHA [1910 1001]<br>OSHA [1910.1101]<br>See Appendix C | Ca<br>[N.D.] | White or greenish (chrysotile), blue (crocidolite), or gray-green (amosite) fibrous, odorless solids. | MW: Varies<br>BP: Decomposes<br>Sol: Insoluble<br>Fl.P: NA<br>IP: NA<br><br>Noncombustible Solid<br>Sp Gr: ? | VP: 0 mm (approx)<br>MLT: 1112°F (Decomposes)<br>UEL: NA<br>LEL: NA | None Reported | Filter, Acetone/ Triacetin; PCM; III [#7400, Fibers] [Also #7402 (TEM)] |
| Carbon tetrachloride<br><br>$CCl_4$<br><br>56-23-5<br>FG4900000<br><br>1846 55 | Carbon chloride,<br>Carbon tet,<br>Freon®10,<br>Halon® 104,<br>Tetrachloromethane<br><br>1ppm = 6.39 mg/m³ | NIOSH<br>Ca<br>ST 2 ppm (12.6 mg/m³) [60-min]<br>See Appendix A<br><br>OSHA<br>10 ppm<br>C 25 ppm<br>200 ppm (5-min. maximum peak in any 4 hours) | Ca<br>[200 ppm] | Colorless liquid with a characteristic ether-like odor. | MW: 153.8<br>BP: 170°F<br>Sol: 0.05%<br>Fl.P: NA<br>IP: 11.47 eV<br><br>Sp. Gr: 1.59<br><br>Noncombustible Liquid | VP: 91 mm<br>FRZ: -9°F<br>UEL: NA<br>LEL: NA | Chemically-active metals such as sodium, potassium & magnesium; fluorine, aluminum<br><br>[Note: Forms highly toxic phosgene gas when exposed to flames or welding arcs.] | Char; $CS_2$; GC/FID, III [#1003, Halogenated Hydrocarbons] |

N.D. = IDLH has not been determined

## Questions:

1. Characteristics of hazardous substances (Check all that apply)

   Corrosive___ Flammable___ Radioactive___ Toxic___Carcinogen___ Reactive___ Volatile___ Other___

2. What is overall hazard rating? (Check one)

   Low___ Moderate___ High___

3. Which OSHA standard would be:

   (a) Applicable to asbestos manufacturing operations? _____

   (b) Applicable to removal of asbestos-containing insulation from buildings? _____

## Conclusion

- Safety and Health Compliance with 29 CFR 1910.120
- Safety and Health Construction Standards
- **Toxic and Hazardous Substances Standards**
- Safety and Health Program, Paragraph (b)

**TP-23**

### Crossword Puzzle

**Down**

11. Subpart Z: _____ and Hazardous Substances
20. Infectious waste
34. Example of substance-specific standard
37. OSHA standard that requires MSDS (acronym)

# APPENDIX
## Fact Sheet

United States Environmental Protection Agency

Office of Solid Waste and Emergency Response

Publication 9360.0-31/FS

August 1993

EPA

# The Effect of OSHA's Bloodborne Pathogens Standard on Hazardous Waste Cleanup Activities

Office of Emergency and Remedial Response
Emergency Response Division MS-101

Quick Reference Fact Sheet

## INTRODUCTION

On December 6, 1991, the Occupational Safety and Health Administration (OSHA) promulgated the Bloodborne Pathogens Standard at 29 CFR 1910.1030 (56 FR 64004), which is designed to protect employees (primarily healthcare workers) whose jobs place them at risk of exposure to blood and other potentially infectious materials. Bloodborne pathogens are microorganisms that are present in human blood and can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus (HBV) and human immunodeficiency virus (HIV). In addition to healthcare workers, the standard also may affect workers who handle waste potentially contaminated with blood or other potentially infectious material during response actions at uncontrolled hazardous waste sites.

The purpose of this Fact Sheet is to describe the additional planning, training, and medical surveillance requirements that the new OSHA standard on bloodborne pathogens imposes upon On-Scene Coordinators (OSCs) and Remedial Project Managers (RPMs) during a Superfund response action. The requirements described in this Fact Sheet are in addition to the requirements specified in 29 CFR 1910.120 (HAZWOPER). For a summary of applicable HAZWOPER requirements for response actions at uncontrolled hazardous waste sites, see *Hazardous Waste Operations and Emergency Response: Uncontrolled Hazardous Waste Sites and RCRA Corrective Actions*, Publication 9285.2-08FS, available from EPA/ERT, 2890 Woodbridge Ave., Building 18 (MS-101), Edison, NJ 08837-3679, (908) 321-6740.

Office of Solid Waste and Emergency Response (OSWER) employees may be covered by OSHA's Bloodborne Pathogens Standard primarily during three field situations:

(1) Cleanup of a hazardous waste site containing infectious waste, especially those employees with collateral first-aid responder duties (operations covered by 29 CFR 1910.120(b) - (o));

(2) Operation of a RCRA-permitted incinerator that burns infectious waste (operations covered by 1910.120(p)); and

(3) Response to an infectious waste spill, such as a transportation accident (operations covered by 1910.120(q)).

At times the requirements in HAZWOPER conflict or overlap with the Bloodborne Pathogens Standard. In such situations, a qualified health and safety professional should determine which provision is more appropriate. In most situations, the provision that is more protective of employee health and safety would apply. Additional assistance can be obtained from EPA's Environmental Response Team in Edison, New Jersey (see the section of this Fact Sheet entitled "Contacts" for the address and telephone number).

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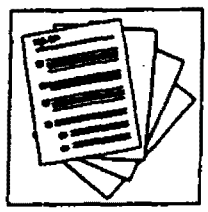
Both the HAZWOPER regulations and the Bloodborne Pathogen Standard require employers to provide written programs (e.g., a health and safety plan or HASP, exposure control, etc.), safety training, medical surveillance, and protective clothing and equipment. Each of these areas is discussed below.

## HEALTH AND SAFETY PLANS



Under the Bloodborne Pathogens Standard, EPA is required to develop an Exposure Control Plan that is designed to minimize occupational exposure to bloodborne pathogens. The Standard defines occupational exposure as "reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials that may result from the performance of an employee's duties." Each Region also must develop an Exposure Control Plan based on the more general EPA plan developed by the Safety, Health, and Environmental Management Division (SHEMD), but reflecting any Region-specific and site-specific hazards. The Exposure Control Plan must contain the following relevant elements:

- An exposure determination, which must contain a list of all job classifications in which some or all employees have occupational exposure, and a list of all tasks and procedures where occupational exposure may occur within these job classifications;

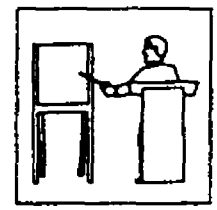
- Schedule and implementation methods for: engineering and work practice controls, personal protective equipment, housekeeping, hepatitis B vaccination and post-exposure evaluation and follow-up, communication of hazards to employees, and recordkeeping; and

- Procedures for the evaluation of circumstances surrounding exposure incidents.

The Exposure Control Plan may be incorporated into existing programs or plans, such as the site-specific HASP or an emergency response plan, or treated as a separate document. If it is incorporated into existing documents, however, the additional elements noted above must be explicitly addressed in the parent document.

The OSHA Compliance Directive reference for this standard may be found at OSHA Instruction CPL 2-2.44B, which contains information that may prove useful when developing Exposure Control Plans. For additional information, see the section of this Fact Sheet entitled "References."

## TRAINING



The Bloodborne Pathogens Standard at 29 CFR 1910.1030(g)(2) requires training for individuals who have the potential to be exposed to bloodborne pathogens in the workplace. Effective training is a critical element of any overall exposure control program and will help reduce the risk of occupational exposure, consequently reducing exposure-related infections. Many of the training requirements are similar to those in HAZWOPER, although a few additional requirements are specified in the Bloodborne Pathogens Standard. Those training elements that are not already covered by HAZWOPER should be included in training programs if employees are likely to be exposed to bloodborne pathogens. The Bloodborne Pathogens Standard requires annual training for employees, just as the HAZWOPER requires 8-hour refresher training. The additional training elements required under the Bloodborne Pathogens Standard are shown in Figure 1.

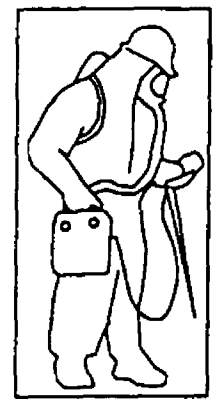
**FIGURE 1**
**Additional Training Elements Covered by the Bloodborne Pathogens Standard**

29 CFR 1910.1030(g)(2)(vii) specifies certain training elements not covered in HAZWOPER:[1]

- An explanation of the epidemiology and symptoms of bloodborne diseases;
- An explanation of the modes of transmission of bloodborne pathogens;
- An explanation of the employer's exposure control plan and the means by which the employee can obtain a copy of the written plan;
- An explanation of methods for recognizing tasks and other activities that may involve exposure to blood or other potentially infectious materials;
- Information on the hepatitis B vaccine;
- Information on the appropriate actions to take and persons to contact in an emergency involving blood or other potentially infectious materials;
- An explanation of the procedure to follow if an exposure incident occurs, including the method of reporting the incident and the medical follow-up that will be made available;
- Information on the post-exposure evaluation and follow-up that the employer is required to provide for the employee following an exposure incident;
- An explanation of the signs and labels and/or color coding required to identify bloodborne pathogen hazards; and
- An opportunity for interactive questions and answers with the person conducting the training session.

[1] Training elements addressing PPE under 29 CFR 1910.1030(g)(2)(vii) are covered under 29 CFR 1910.120.

## PERSONAL PROTECTIVE EQUIPMENT (PPE)



The Bloodborne Pathogens Standard at 29 CFR 1910.1030(d)(3) specifies that masks, in combination with eye protection devices, such as goggles or glasses with solid side shields, or chin-length face shields, must be worn whenever a splash, spray, spatter, or drops of blood or other potentially infectious materials may be generated and eye, nose, or mouth contamination can be reasonably anticipated.

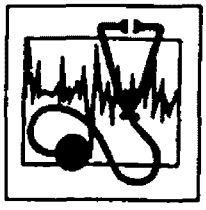
In addition, appropriate protective clothing (including, but not limited to, gowns, aprons, lab coats, clinic jackets, or similar outer garments) must be worn in occupational exposure situations. The type of PPE that is appropriate in a given situation will depend upon the task and anticipated degree of exposure potential to bloodborne pathogens. HAZWOPER PPE Levels A through C should be effective in protecting a worker from exposure to bloodborne pathogens. In instances where level C or higher is not being worn, it may be prudent to use double gloves.

Gloves are an important element of PPE when bloodborne pathogens may be present.

- Gloves must be worn when the employee may have hand contact with blood and other potentially infectious materials.
- When contaminated or damaged, disposable gloves must be replaced as soon as possible and should not be reused.
- Utility gloves may be decontaminated for re-use if the gloves are not damaged.

In extremely rare instances, such as unexpected medical emergencies, employees may not be able to put on gloves, gowns, or face masks. In these types of rare situations, where some leeway must be allowed, employees must still be cognizant of the underlying concept of universal precautions (i.e., all blood and body fluids should be treated as if they are infectious). However, as stated at 29 CFR 1910.1030(d), normal operations would dictate that, "The employer shall ensure that the employee uses appropriate personal protective equipment unless the employer shows that the employee temporarily and briefly declined to use personal protective equipment when, under rare and extraordinary circumstances, it was the employee's professional judgement that in the specific instance its use would have prevented the delivery of health care or public safety services or would have posed an increased hazard to the safety of the worker or co-worker. When the employee makes this judgement, the circumstances shall be investigated and documented in order to determine whether charges can be instituted to prevent such occurrences in the future." It is worth noting that should an exposure occur while an employee is wearing a level of protective clothing, decontamination may need to be modified to include agents (e.g., disinfectant) other than the traditional soap and water.

## MEDICAL SURVEILLANCE



The Bloodborne Pathogens Standard at 29 CFR 1910.1030(f)(1) provides several additional requirements that are applicable when employees are exposed to bloodborne pathogens. First, the hepatitis B vaccine and vaccination series must be made available at no cost to all employees who have occupational exposure, or the potential for exposure (e.g., first-aid responders as a collateral duty on a hazardous waste site), and there must be post-exposure evaluations and follow-ups for all employees who have had an exposure incident. The vaccine must be available after training is complete and within 10 working days of the initial assignment to all employees who have occupational exposure. Declining the pre-exposure shot must be done in writing, as required by the Bloodborne Pathogens Standard at 29 CFR 1910.1030 (f)(2)(iv), with the understanding that it is still available at a later date.

Second, there are specific reporting requirements when there is an exposure incident. An "exposure incident" is defined at 29 CFR 1910.1030(b) as "a specific eye, mouth, other mucous membrane, non-intact skin, or parenteral contact with blood or other potentially infectious materials that results from the performance of an employee's duties." Following the report of an exposure incident, the employer must make a confidential medical evaluation and follow-up immediately available to the exposed employee. Evaluation and follow-up must include:

- Identification of the route(s) of exposure and the circumstances under which the exposure incident occurred;
- Identification and documentation of the source individual, unless identification is infeasible or prohibited by state or local law;
- Collection, documentation, and testing of blood for HBV and HIV serological status (source individual's blood must be tested and results made available to the exposed employee, even if source individual cannot be identified). Specifics can be found at 29 CFR 1910.1030 (f)(3)(ii) and (f)(3)(iii);
- Post-exposure prophylaxis;
- Counseling; and
- Evaluation of reported illnesses.

Finally, medical records must be kept for each employee with occupational exposure. These records should include a copy of: the status and dates of the employee's hepatitis B vaccination; all examination and medical test results, and specifications of follow-up procedures; the healthcare professional's written opinion; and a copy of the written information provided by the employer to the healthcare professional.

## CONCLUSION

The new OSHA standard on bloodborne pathogens contains requirements for health and safety planning, training, medical surveillance, and personal protective equipment. These requirements are in addition to the HAZWOPER requirements whenever the HAZWOPER and Bloodborne Pathogens standard overlap. Blood and other potentially infectious material should always be treated as if they are infectious: the hepatitis B virus and the HIV are extremely serious hazards. The health and safety requirements specified in this Fact Sheet are a summary of the minimum standards that must be followed when there is occupational exposure to bloodborne pathogens. Anyone working with waste contaminated with blood or other potentially infectious material should refer to the latest EPA national and Regional policies, programs, and Standard Operating Practices.

## REFERENCES

*Occupational Exposure to Bloodborne Pathogens*, OSHA 3127 (1992).

*Occupational Exposure to Bloodborne Pathogens: Precautions for Emergency Responders*, OSHA 3130 (1992).

## CONTACTS

EPA/Environmental Response Team
2890 Woodbridge Avenue
Building 18, Mail Code MS 101
Edison, NJ 08837-3679
(908) 321-6740

EPA/Safety, Health, and Environmental Management Division (SHEMD)
Mail Code PM 273
401 M Street, SW
Washington, DC 20460
(202) 260-1640 or (202) 260-1647

Occupational Safety and Health Administration
200 Constitution Avenue, NW
Room N-3647
Washington, DC 20210
(202) 219-8036

OSHA Notification Service (Complaint Hotline) for Emergency Situations
1-800-321-6742

OSHA Publications Office
200 Constitution Avenue, NW
Room N-3101
Washington, DC 20210
(202) 219-4667

## OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
## REGIONAL OFFICES

Region I (CT, MA, ME, NH, RI, VT)
133 Portland Street, 1st Floor
Boston, MA 12114
(617) 565-7164

Region II (NJ, NY, PR, VI)
201 Varick Street, Room 670
New York, NY 10014
(212) 337-2378

Region III
(DC, DE, MD, PA, VA, WV)
Gateway Building, Suite 2100
3535 Market Street
Philadelphia, PA 19104
(215) 596-1201

Region IV
(AL, FL, GA, KY, MS, NC, SC, TN)
1375 Peachtree Street, NE
Suite 587
Atlanta, GA 30367
(404) 347-3573

Region V (IL, IN, MI, MN, OH, WI)
230 South Dearborn Street,
Room 3244
Chicago, IL 60604
(312) 353-2220

Region VI (AR, LA, NM, OK, TX)
525 Griffin Street, Room 602
Dallas, TX 75202
(214) 767-4731

Region VII (IA, KS, MO, NE)
911 Walnut Street, Room 406
Kansas City, MO 64106
(816) 426-5861

Region VIII
(CO, MT, ND, SD, UT, WY)
Federal Building, Room 1576
1961 Stout Street
Denver, CO 80294
(303) 844-3061

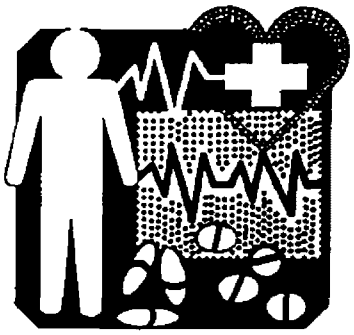
Region IX (American Samoa, AZ, CA, Guam, HI, NV, Trust Territories of the Pacific)
71 Stevenson Street, Room 415
San Francisco, CA 94105
(415) 744-6670

Region X (AK, ID, OR, WA)
1111 Third Avenue, Suite 715
Seattle, WA 98101-3212
(206) 553-5930

(NOTE: Refer to the Regional Area Office first; call the National Office if your inquiry cannot be adequately addressed.)

# SAFETY AND HEALTH PROGRAM PARAGRAPH (b)

# Safety and Health Program Paragraph (b)



TP-1

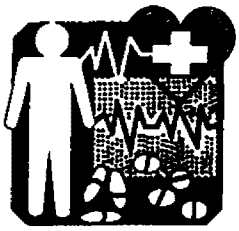
## *Module Goals:*

The student goals for this module are:

1. Given 1910.120(b), identify the components of a safety and health program.

2. Given 29 CFR 1910.120(b)(4) and conditions found on a hazardous waste site, identify the components of a site-specific health and safety plan (HASP).

# Safety and Health Program

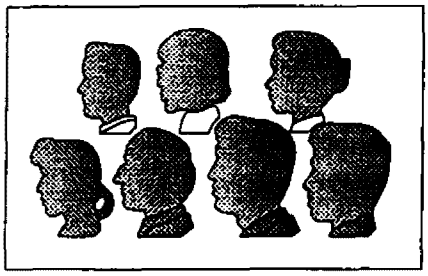


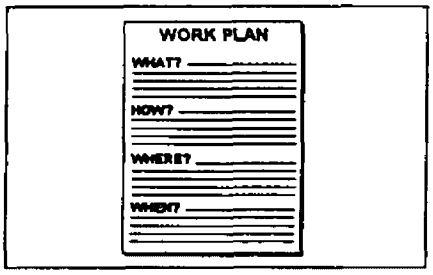
A _____ program that serves as an organization-wide safety and health policy that applies to all personnel regardless of the location where they are working.

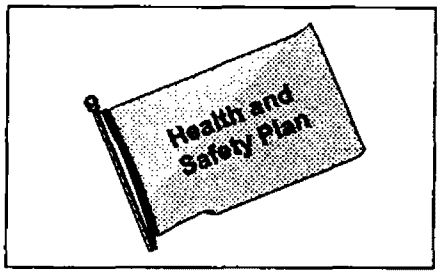
**TP-2**

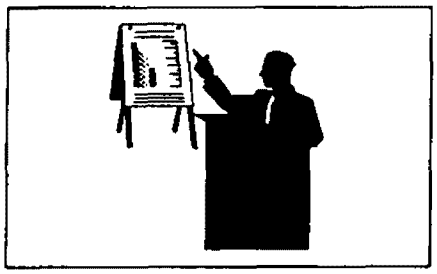
Given 29 CFR 1910.120(b), list the components of a safety and health program.

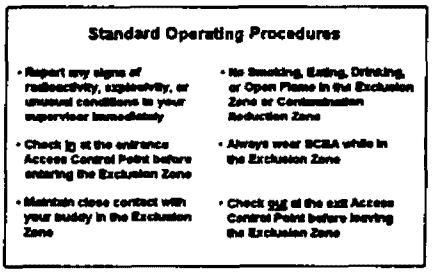
# Seven Components of a Safety and Health Program

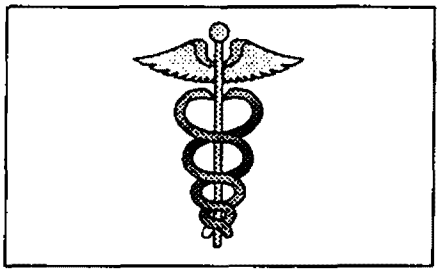


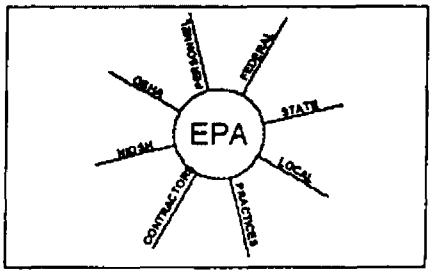


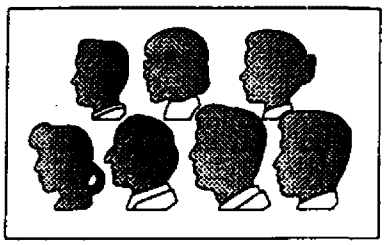








TP-3



## Organizational Structure

The organizational structure specifies overall responsibilities of _____ and employees in carrying out the safety and health program.

**TP-4**

Functions of Organizational Structure

1. Identify a **leader** who has the authority to direct all activities.

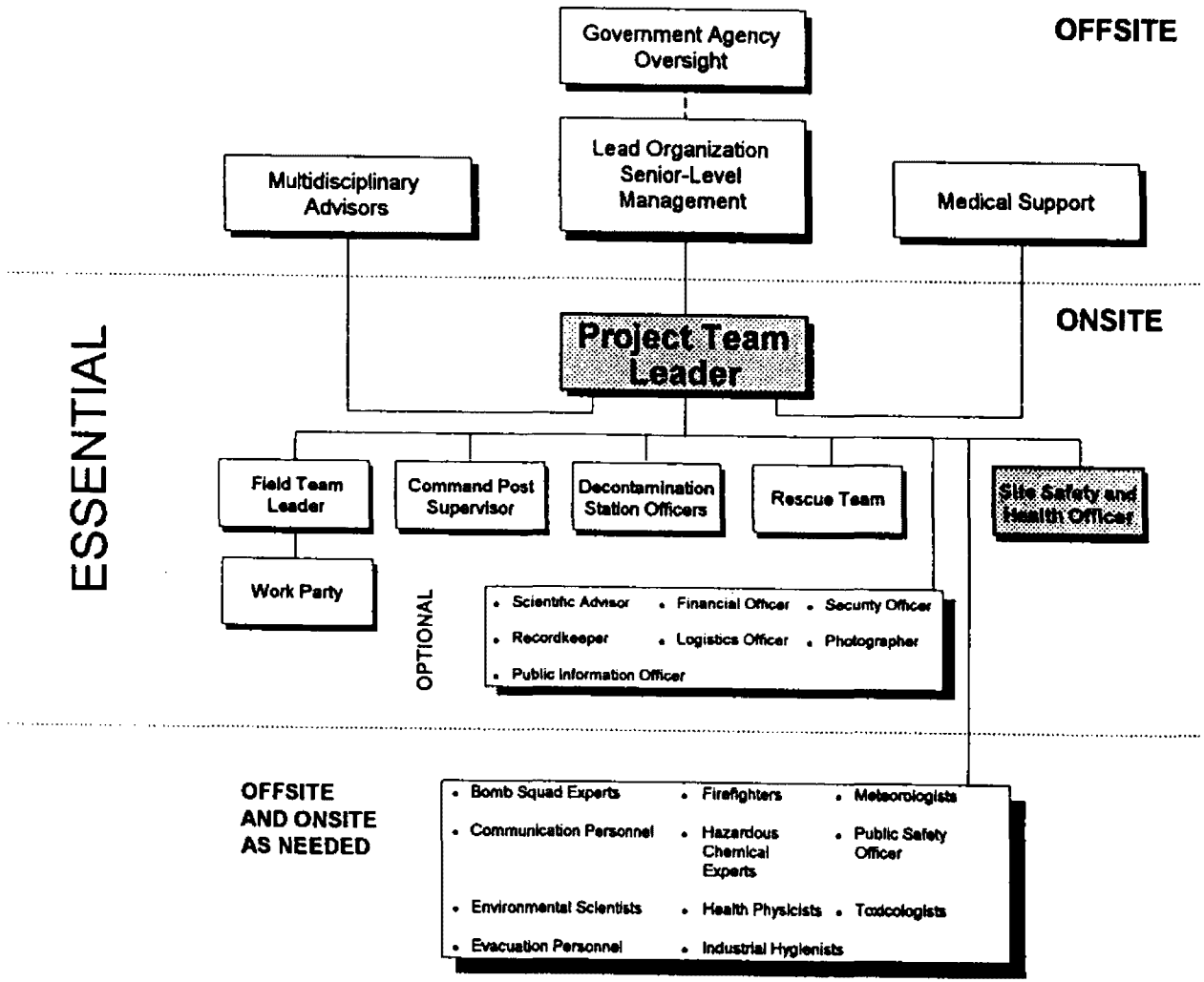
2. Identify the other **personnel** needed for the project and assign their general functions and responsibilities.

3. Show lines of **authority**, responsibility, and communication.

4. Identify the **interface** with the response community.

*Source:* U.S. DHHS 1985, p. 3-1

# Safety and Health Program



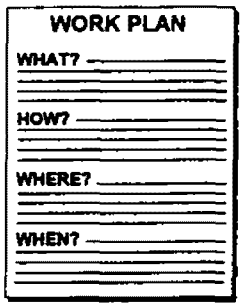

*Source:* U.S. DHHS 1985, p. 3-2, Figure 3-1

| Onsite Essential Personnel | |
|---|---|
| **Title** | **General Description** |
| **Project Team Leader** | Reports to upper-level management. Has authority to direct response operations. Assumes total control over site activities. |
| **Site Safety and Health Officer** (hereafter referred to as Site Safety Officer in accordance with common usage) | Advises the Project Team Leader on all aspects of health and safety onsite. Recommends stopping work if any operation threatens worker or public health or safety. |
| **Field Team Leader** | May be the same person as the Project Team Leader and may be a member of the work party. Responsible for field team operations and safety. |
| **Command Post Supervisor** | May be the same person as the Field Team Leader. Responsible for communications and emergency assistance. |
| **Decontamination Station Officer(s)** | Responsible for decontamination procedures, equipment, and supplies. |
| **Rescue Team** | Used primarily on large sites with multiple work parties in the contaminated area. |
| **Work Party** | Depending on the size of the field team, any or all of the field team may be in the Work Party, but the Work Party should consist of at least two people. |

| Onsite Optional Personnel | |
|---|---|
| **Title** | **Specific Responsibilities** |
| **Scientific Advisor** | Provides advice for:<br>Field monitoring — Scientific studies<br>Sample collection — Data interpretation<br>Sample analysis — Remedial plans |
| **Logistics Officer** | Plans and mobilizes the facilities, materials, and personnel required for the response. |
| **Photographer** | Photographs site conditions.<br>Archives photographs. |
| **Financial/Contracting Officer** | Provides financial and contractual support. |
| **Public Information Officer** | Releases information to the news media and to the public concerning site activities. |
| **Security Officer** | Manages site security. |
| **Recordkeeper** | Maintains the official records of site activities. |

*Source:* U.S. DHHS 1985, p. 3-4 and 3-5

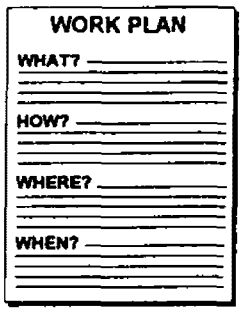
## Site-specific Work Plan Development Steps




- Review available information, including:
  - Site records.
  - Waste inventories.
  - Generator and transporter manifests.
  - Previous sampling and monitoring data.
  - Site photographs.
  - State and local environmental and health agency records.

TP-6

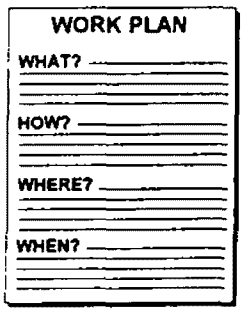
## Site-specific Work Plan Development Steps (cont.)




- Define work objectives.
- Determine methods for accomplishing the objectives (e.g., sampling plan, inventory, disposal techniques).
- Determine personnel requirements.

TP-7

## Site-specific Work Plan Development Steps (cont.)




- Determine the need for additional training of personnel. Evaluate their current knowledge and skill level against the tasks they will perform and the situations they may encounter.
- Determine equipment requirements.

TP-8

Given 29 CFR 1910.120(b)(4), list the components of a site-specific health and safety plan.

## Site-specific Health and Safety Plan

Establishes policies and _____ to protect workers and the public from the potential hazards posed by a hazardous waste site.

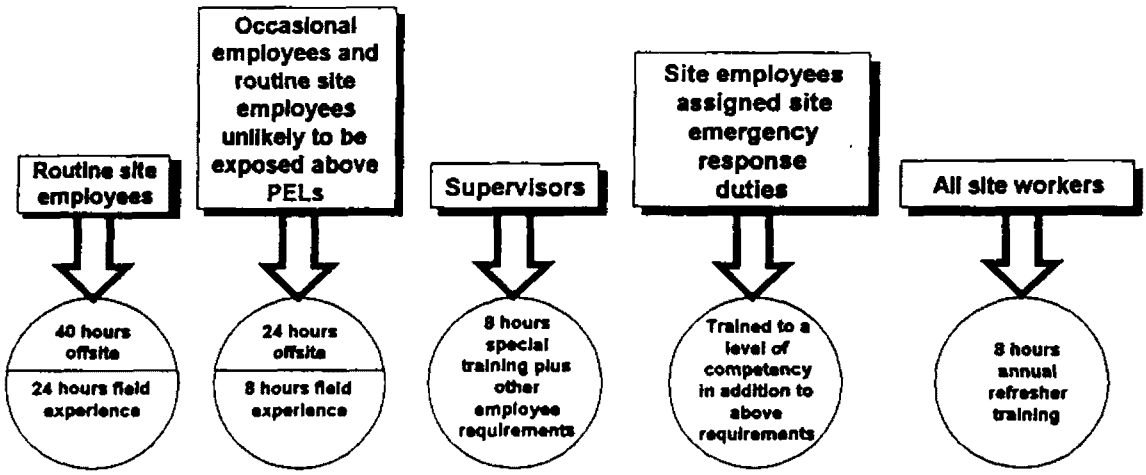
*Source:* U.S. DHHS 1985, p. 3-5

**TP-9**

Components of a Site-specific Health and Safety Plan

1. Key personnel
2. **Health and safety risk analysis**
3. Site control measures
4. Training assignments
5. Medical surveillance requirements
6. **Personal protective equipment**
7. **Air and employee monitoring**
8. **Spill containment program**
9. **Confined space procedures**
10. Decontamination procedures
11. **Emergency response plan**

# Initial Training Requirements for Employees at Uncontrolled Hazardous Waste Sites 29 CFR §1910.120(e)




*Source:* U.S. EPA 1992, Exhibit 3-2

**TP-10**

Examples of Site Workers and Tasks Within Training Categories

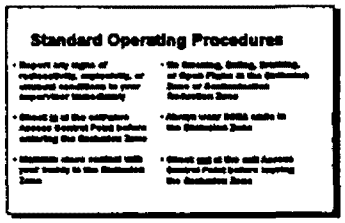
| | |
|---|---|
| Routine site employee: | Equipment operators, general laborers; hazardous substance removal; activities which will or could expose the worker. |
| Occasional site employee: | Groundwater monitoring, land survey, inspection activities, and other tasks not likely to expose employee above permissible exposure limits (PELs) and published exposure limits. |
| Supervisors: | Management and supervisory personnel directly responsible for general (routine) or occasional site workers. |
| Emergency response: | Any employee who takes action (including defensive actions) in response to an emergency. |

# Recommended Training by Job Category

| Training Topic | Emphasis of Training | General Site Worker | Onsite Management & Supervisors | Health & Safety Staff |
|---|---|---|---|---|
| **Biology, Chemistry, and Physics of Hazardous Materials** | Chemical and physical properties; chemical reactions; chemical compatibilities. | ✓ | ✓ | ✓ |
| **Toxicology** | Dosage, exposure routes, toxicity, IDLH values, PELs, recommended exposure limits (RELs), TLVs. | ✓ | ✓ | ✓ |
| **Industrial Hygiene** | Monitoring workers' need for and selection of PPE. | O | ✓ | ✓ |
| | Calculation of doses and exposure levels; hazard evaluation; selection of worker health and safety protective measures. | O | ✓ | ✓ |
| **Monitoring Equipment** | Selection, use, capabilities, limitations, and maintenance. | ✓ | ✓ | ✓ |
| **Hazard Evaluation/ Recognition** | Techniques of sampling and assessment. | ✓ | ✓ | ✓ |
| | Evaluation of field and lab results. | O | ✓ | ✓ |
| | Chemical/physical. | ✓ | ✓ | ✓ |
| | Risk assessment. | | O | ✓ |
| **Site Safety Plan** | Safe practices, safety briefings and meetings, standard operating procedures, site safety map. | ✓ | ✓ | ✓ |
| **Standard Operating Procedures** | Hands-on practice. | ✓ | ✓ | ✓ |
| | Development and compliance. | O | ✓ | ✓ |
| **Engineering Controls** | The use of barriers, isolation, and distance to minimize hazards. | ✓ | ✓ | ✓ |
| **Personal Protective Clothing and Equipment (PPE)** | Assignment, sizing, fit-testing, maintenance, use, limitations, and hands-on training. | ✓ | ✓ | ✓ |
| | Selection of PPE. | ✓ | ✓ | ✓ |
| **Medical Program** | Medical monitoring, first aid, stress recognition. | ✓ | ✓ | ✓ |
| | CPR and emergency drills. | O | ✓ | ✓ |
| | Design and planning. | | O | ✓ |
| | Implementation. | ✓ | ✓ | ✓ |
| **Decontamination** | Hands-on training using simulated field conditions. | ✓ | ✓ | ✓ |
| | Design and maintenance. | ✓ | ✓ | ✓ |
| **Legal and Regulatory Aspects** | Applicable safety and health regulations (OSHA, EPA). | O | ✓ | ✓ |
| **Emergencies/Accidents** | Emergency help, self-rescue, drills, alarms, reporting. | ✓ | ✓ | ✓ |
| | Emergency response, investigation, and documentation. | O | ✓ | ✓ |
| **Hazard Communication** | Per 29 CFR § 1910.200 and § 1926.59 (as applicable). | ✓ | ✓ | ✓ |
| **Employee Rights** | | ✓ | ✓ | ✓ |

**Key:**
**✓ = Recommended Training**
**O = Optional Training**

*Source:* U.S. EPA 1992, p. 28, Exhibit 3-3




# Standard Operating Procedures

Provide uniform methods of work that ensure:

- _____ safety
- Regulatory _____
- _____ of results

**TP-11**

## Medical Surveillance

1. Medical monitoring
2. Biological monitoring

TP-12

Definitions:

Medical monitoring: Series of medical tests performed to determine an individual's condition as it relates to a particular occupational qualification.

Biological monitoring: Series of medical tests performed to determine whether an individual has received an occupational exposure.

## Types of Physicals

1. Prescreening
2. Periodic
3. Unscheduled
4. Termination

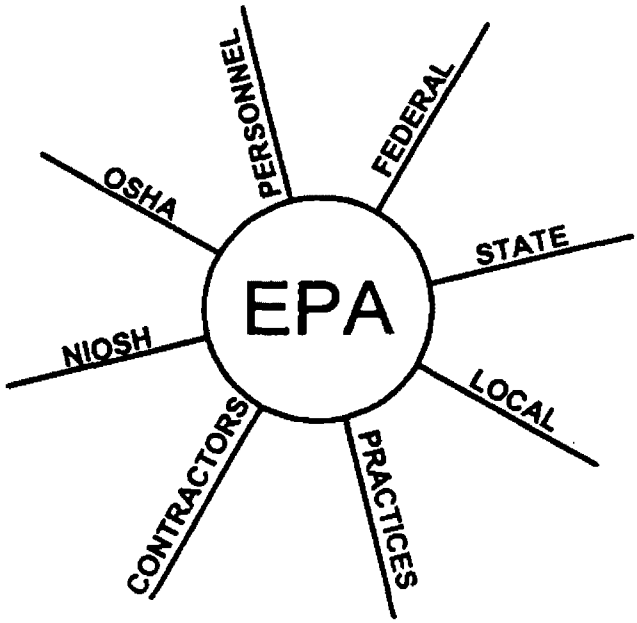
TP-13

# Medical Surveillance Program

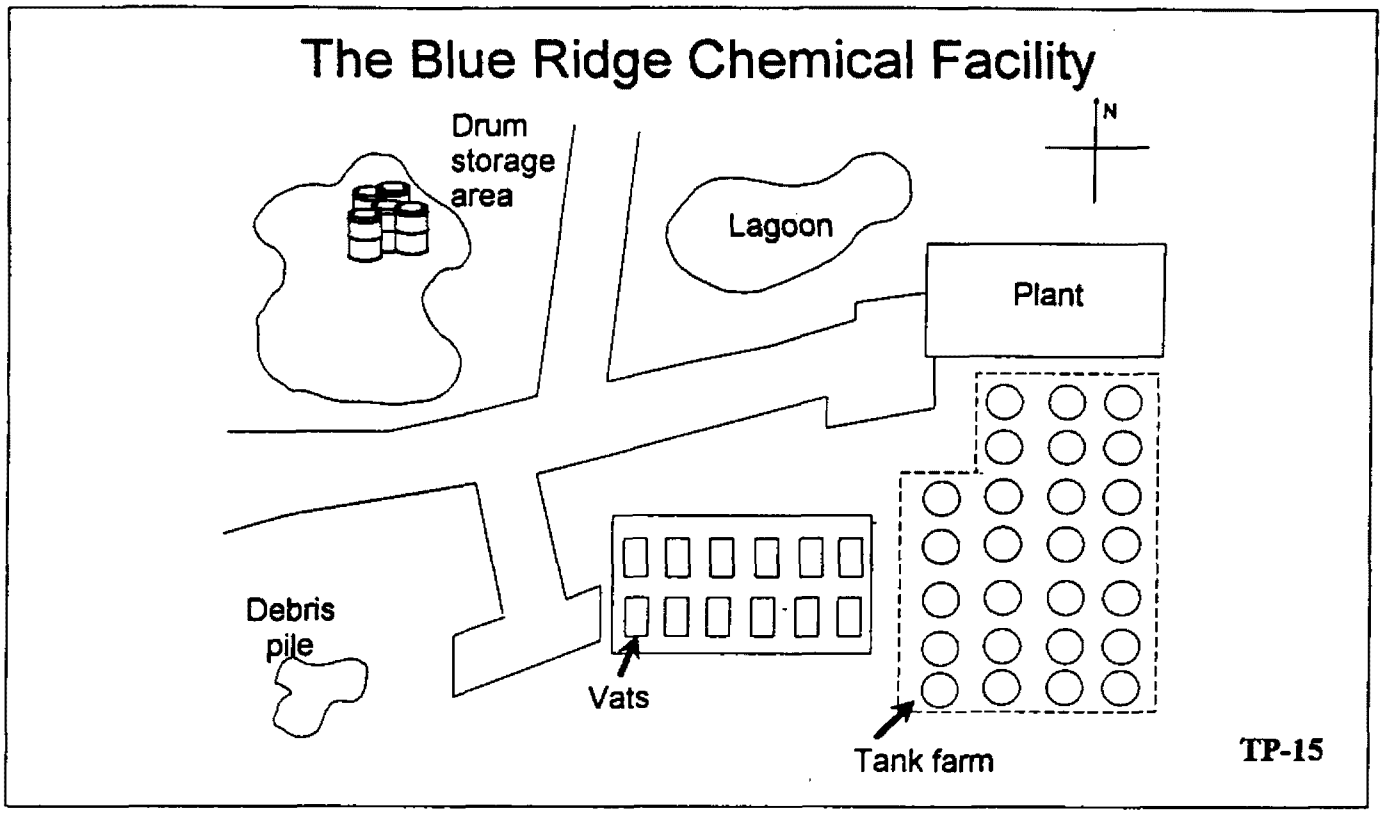
| COMPONENT | RECOMMENDED | OPTIONAL |
|---|---|---|
| **Preemployment Screening** | • Medical history.<br>• Occupational history.<br>• Physical examination.<br>• Determination of fitness to work wearing protective equipment.<br>• Baseline monitoring for specific exposures. | • Freezing preemployment serum specimen for later testing. |
| **Periodic Medical Examinations** | • Yearly update of medical and occupational history; yearly physical examination; testing based on examination results, exposures, and job class and task.<br>• More frequent testing based on specific exposures. | • Yearly testing with routine medical tests. |
| **Emergency Treatment** | • Provide emergency first aid onsite.<br>• Develop liaison with local hospital and medical specialists.<br>• Arrange for decontamination of victims.<br>• Arrange in advance for transport of victims.<br>• Transfer medical records; give details of incident and medical history to next care provider. | |
| **Nonemergency Treatment** | • Develop mechanism for non-emergency health care. | |
| **Recordkeeping and Review** | • Maintain and provide access to medical records in accordance with OSHA and state regulations.<br>• Report and record occupational injuries and illnesses.<br>• Review Site Safety Plan regularly to determine whether additional testing is needed.<br>• Review program periodically. Focus on current site hazards, exposures, and industrial hygiene standards. | |

*Source:* U.S. DHHS 1985, p. 5-2, Table 5-1

# Coordination of Procedures




TP-14




| Chemicals of Concern | Informational Resources | Target Organs | Exposure Pathways |
|---|---|---|---|
| | **29 CFR 1926.1101. NIOSH Pocket Guide, ACGIH TLV-BEI booklet.** | | |

Medical Surveillance Requested: _____

**Training Matrix**

| | 40-hour Offsite/ 24-hour Onsite | 24-hour Offsite/ 8-hour Onsite | 8-hour Additional | Emergency Response | Refresher Training |
|---|---|---|---|---|---|
| **Routine** | | | | | |
| **Occasional** | | | | | |
| **Supervisor** | | | | | |
| **Emergency** | | | | | |

## Conclusion

- Safety and Health Compliance with 29 CFR 1910.120
- Safety and Health Construction Standards
- Toxic and Hazardous Substances Standards
- **Safety and Health Program, Paragraph (b)**

**TP-16**

### Crossword Puzzle

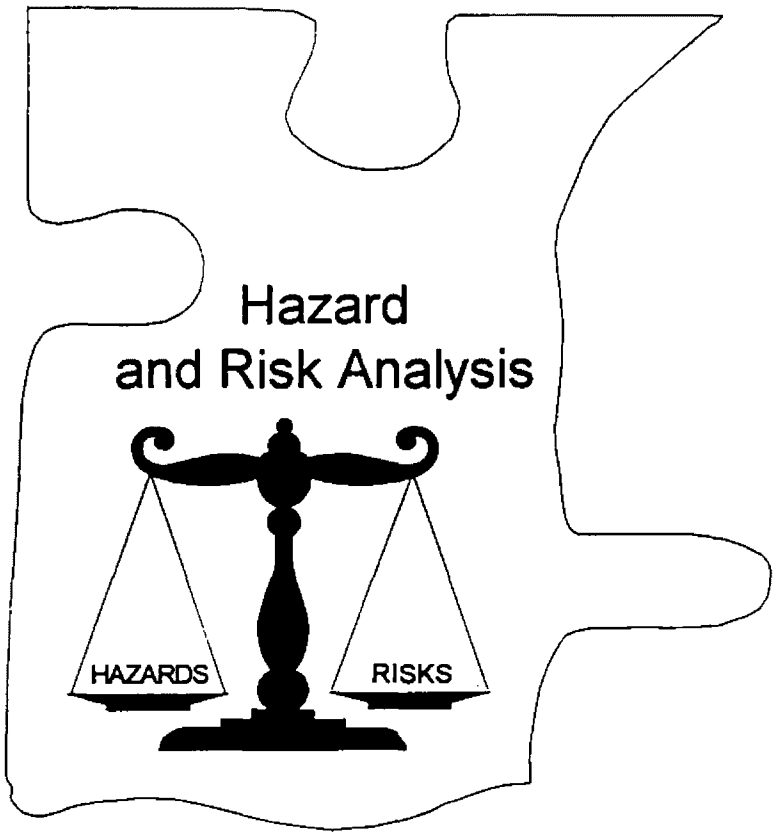
**Across**

1. Safety and health _____
38. A written document of "how to

**Down**

32. Develops competency
36. As important as health

# HAZARD AND RISK ANALYSIS




TP-1

## *Module Goals:*

The student goals for this module are:

1. Given available published technical references and a hazardous waste site, describe the process used to assess hazards and risks onsite.

2. Given limits set in regulations, available published technical references, and knowledge of the conditions that exist on a hazardous waste site, identify hazards that exist onsite.

3. Given regulatory guidance such as permissible exposure limits (PELs), immediately dangerous to life or health (IDLH) concentrations, available published technical references, and a list of existing and potential onsite hazards, perform a hazard and risk analysis in order to establish decision-making criteria for worker protection.

Define hazard and risk analysis.

- A _____ is any existing or potential condition in the workplace which, by itself or by interacting with other variables, can result in the unwanted effects of death, injury, property damage, or other losses.
- ____ is an estimate of the probability or likelihood that an adverse event will occur.

TP-2

## Definition of Hazard and Risk Analysis

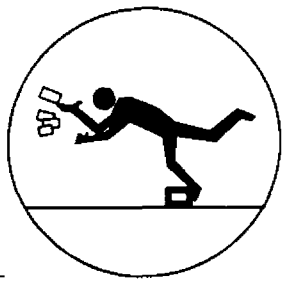
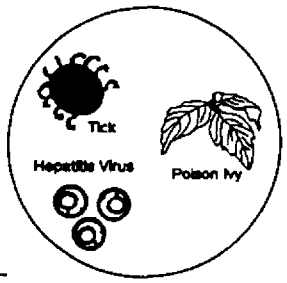
A process of identifying hazards associated with a job task, evaluating the risks, and developing procedures and safe work practices to reduce or eliminate those risks.

TP-3

Given U.S. EPA standard operating safety guides (SOSGs) and other available published technical references:

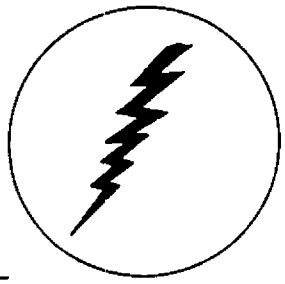
- List the hazard categories.

# Physical Hazard Categories

| Name | | Examples |
|---|---|---|
| Kinetic |  | • _____<br>• _____<br>• _____ |
| Biological |  | • _____<br>• _____<br>• _____ |

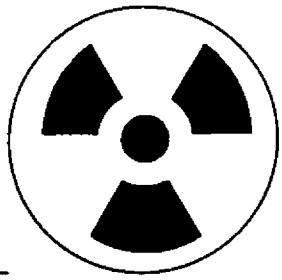
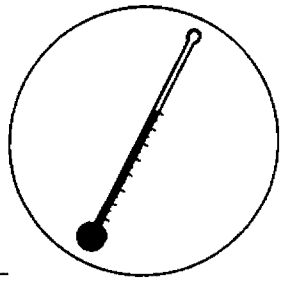
TP-4

# Physical Hazard Categories (cont.)

| Name | Examples |
|---|---|
| Noise and vibration | • _____<br>• _____<br>• _____ |
|  Electrical | • _____<br>• _____<br>• _____ |

TP-5

# Physical Hazard Categories (cont.)

| Name | | Examples |
|---|---|---|
| Radiation |  | • _____<br>• _____<br>• _____ |
| Thermal |  | • _____<br>• _____<br>• _____ |

TP-6

## Heat Stress and Cold Exposure

**Heat rash**: Caused by continuous exposure, humid conditions, and excessive perspiration. Symptoms include mild red rash frequently found on body areas that are in contact with protective clothing.

**Heat cramps**: Painful spasms of skeletal muscles when excessive electrolytes are lost through perspiration. Symptoms include muscle cramps.

**Heat exhaustion**: Occurs in individuals working in hot environments, typically after sustained heat stress of a few days. Symptoms include general weakness, fatigue, anxiety, and/or impaired judgment; pale, clammy skin; profuse sweating and intense thirst; and a weak pulse. Worker will generally have normal body temperature. Worker may lapse into unconsciousness.

**Heat stroke**: A breakdown of the body's heat-regulating mechanism. It is the most severe form of heat stress and is a life-threatening condition. If effective treatment is not received promptly, the chances of death are up to 80%. Symptoms include sudden onset with loss of consciousness; dry, hot, flushed skin; dilated pupils; bounding pulse and convulsions; and elevated body temperature (105°–110°F).

**Frostbite**: Freezing of tissues (usually local injuries to exposed skin of extremities, cheeks, nose, and ears). Symptoms can include skin blanching, tingling, and pain. In severe frostbite, the skin is waxy, hard to the touch, and numb.

**Hypothermia**: The lowering of core body temperature. It is the most severe form of cold stress. It is a life-threatening condition requiring immediate medical care. Symptoms can include shivering; apathy, listlessness, sleepiness, and rapid cooling of the body to less than 95°F; glassy stare, unconsciousness, slow pulse, and respiratory rate; freezing extremities; and death.

Given SOSGs and other available published technical references:

- List the chemical and physical properties resulting in chemical hazards.
- List other safety and health hazards.

## Chemical Hazard Categories

| Name | | Causes |
|---|---|---|
| Fire and explosion | | • _____<br>• _____<br>• _____ |
| Oxygen deficiency | | • _____<br>• _____<br>• _____ |

TP-7

# Chemical Hazard Categories (cont.)

| Name | | Causes |
|---|---|---|
| Corrosivity | | • _____<br>• _____<br>• _____ |
| Toxicity | | • _____<br>• _____<br>• _____ |

TP-8

Given the following tasks, list specific hazards associated with each one.

Four 8×10 photographs have been placed on each table. Each photograph is numbered on the back. Below you will find tasks associated with each photograph. Fill in the matrix for each photograph by ranking the hazards low, medium, or high.

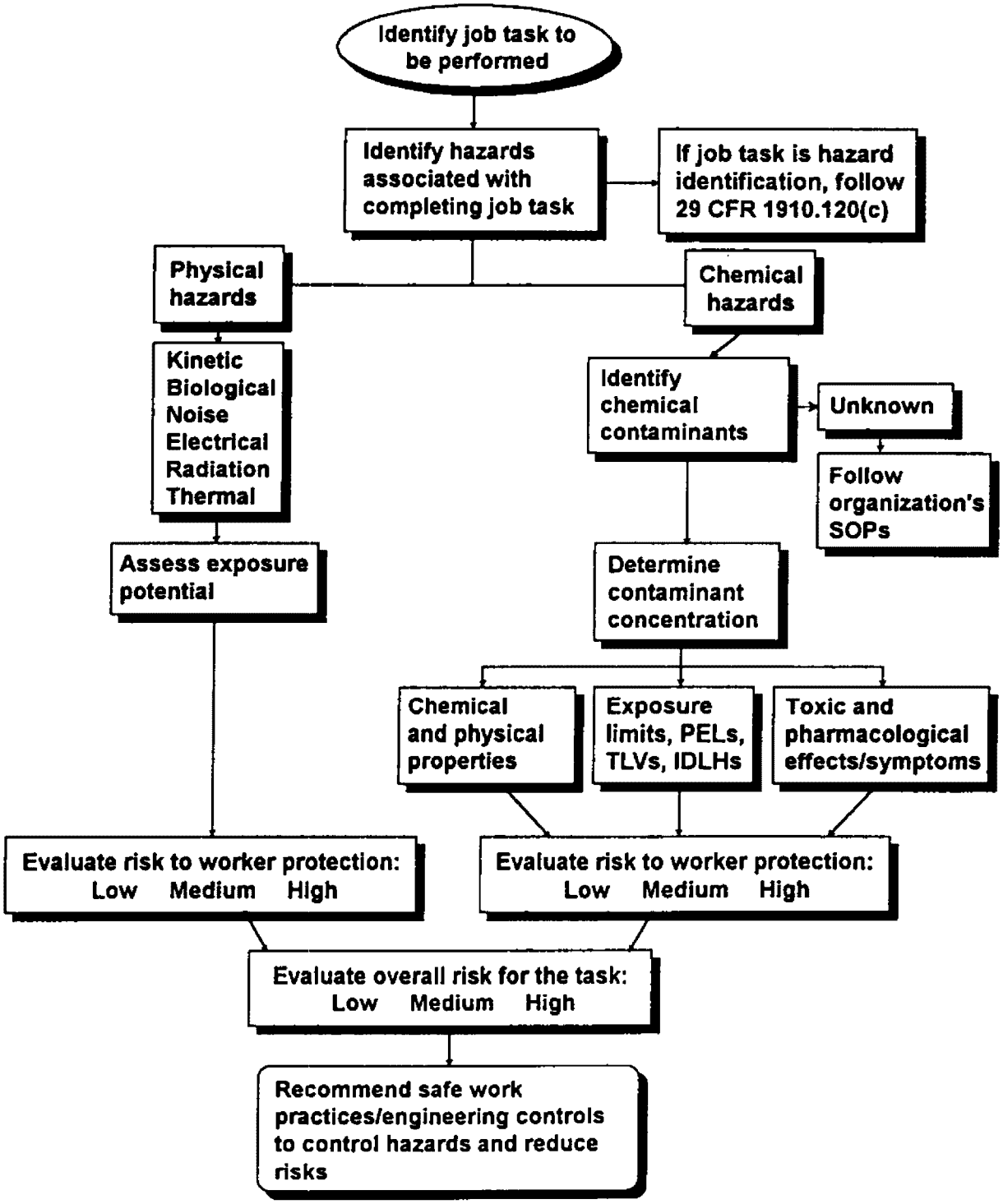
$P_1$ - Task is site characterization
$P_2$ - Task is sampling containers
$P_3$ - Task is lagoon sampling with a cherry picker
$P_4$ - Task is lagoon sampling with a boat

**Time limit:** 5 minutes.

| | $P_1$ | $P_2$ | $P_3$ | $P_4$ |
|---|---|---|---|---|
| Kinetic | | | | |
| Biological | | | | |
| Noise | | | | |
| Electrical | | | | |
| Radiation | | | | |
| Thermal | | | | |
| Fire/Explosion | | | | |
| $O_2$ Deficiency | | | | |
| Corrosivity | | | | |
| Toxicity | | | | |

KEY
L = Low hazard H = High hazard
M = Medium hazard NA = Not applicable

# Hazard and Risk Analysis Flowchart




*Source:* U.S. DHHS 1985

# Hydrazine Excerpt

| Chemical name, structure/formula, CAS and RTECS Nos., and DOT ID and guide NOS. | Synonyms, trade names, and conversion factors | Exposure limits (TWA unless noted otherwise) | IDLH | Physical description | Chemical and physical properties: MW, BP, SOL, Fl.P, IP, Sp.Gr, flammability | Chemical and physical properties: VP,FRZ, UEL,LEL | Incompatibilities and reactivities | Meaurement method (See Table 1) |
|---|---|---|---|---|---|---|---|---|
| Hydrazine<br>$N_2H_4$<br>302-01-2<br>MU7175000<br>2030 59 (<64% soln)<br>2029 28 (>64% soln) | Diamine, Hydrazine (anhydrous), Hydrazine base<br>1 ppm = 1.33 mg/m³ | NIOSH<br>Ca<br>See Appendix A<br>C 0.03 ppm<br>(0.04 mg/m³)<br>[2-hr]<br>OSHA<br>0.1 ppm<br>(0.1 mg/m³)<br>[skin] | Ca<br>[80 ppm]<br>ACGIH<br>A2 | Colorless liquid with an ammonia-like odor.<br>[Note: A solid below 36°F.] | MW: 32.1<br>BP: 236°F<br>Sol: Miscible<br>Fl.P: 99°F<br>IP: 8.93 eV<br>Sp.Gr: 1.01<br>Class IC Flammable Liquid | VP: 10 mm<br>FRZ: 36°F<br>UEL: 98%<br>LEL: 2.9% | Oxidizers, hydrogen peroxide, nitric acid, metallic oxides,acids<br>[Note: Can ignite SPONTANEOUSLY on contact with oxidizers or porous materials such as earth, wood, and cloth.] | Bub;<br>Reagent;<br>Vis;<br>III<br>[#3503] |

| Personal protection and sanitation (See Table 3) | | Recommendations for respirator selection — maximum concentration for use (MUC) (See Table 4) | Health hazards: Route | Symptoms (See Table 5) | First Aid (See Table 6) | | Target Organs (See Table 5) |
|---|---|---|---|---|---|---|---|
| Clothing:<br>Goggles:<br>Wash:<br>Change:<br>Remove:<br>Provide: | Any poss<br>Any poss<br>Immed contam<br>N.R.<br>Immed wet (flamm)<br>Eyewash, quick drench | NIOSH<br>¥: SCBAF:PD,PP/SAF:PD,PP:ASCBA<br>Escape: SCBAE | Inh<br>Abs<br>Ing<br>Con | Irrit eyes, nose, throat; temporary blindness, dizz, nau; derm; burns skin, eyes; [carc];<br>In animals: bron, pulm edema; liver, kidney damage; convuls | Eye:<br>Skin:<br>Breath:<br>Swallow: | Irr immed<br>Water flush immed<br>Resp support<br>Medical attention immed | CNS, resp sys, skin, eyes |

*Source:* NIOSH Pocket Guide (U.S. DHHS 1994)

# Hazard and Risk Analysis Matrix

| TASKS | HAZARD CATEGORIES: KINETICS | BIOLOGICAL | NOISE | ELECTRICAL | RADIATION[a] | THERMAL[b] | LEL[c] | OXYGEN | REACTIVES | TOXICS | JUSTIFICATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Drum Crushing | X | | X | | | X | X | | X | X | Noise - Machinery used to crush drum |
| Site Survey | X | X | | | | | X | X | | X | Biological - Poison ivy, ticks, snake bites |
| Grid Layout | X | X | | | X | | X | | | X | |
| Perimeter Monitoring | X | X | | | X | | X | | | X | |
| Ground Penetrating Radar | X | X | | | | | | | | X | |
| Air Sampling/Monitoring | X | X | | | | | X | X | | X | |
| Stack/Vent Monitoring | X | X | | | | | X | | | X | LEL - Landfill vents release methane |
| Surface Soil Sampling | X | X | | X | | | | | | X | Biological - Poison ivy, ticks, snake bites |
| Subsurface Soil Sampling | X | X | | X | X | | X | X | | X | Biological - Poison ivy, ticks, snake bites |
| Soil Borings | X | | X | X | X | | X | | | X | |
| Groundwater Well Installation | X | X | X | X | | | X | | | X | Electrical - Underground and overhead lines |
| Groundwater Sampling | X | X | | X | | | X | | | X | Electrical - Pump for sampling |
| Surface Water Sampling | X | X | | | | | | | | X | |
| Lagoon Sampling | X | X | | | | | X | | X | X | |
| Test Pit Excavations | X | | X | X | | X | X | X | | X | LEL - Concentration of flammable gas due to confined area |
| Soil Excavations | | | X | X | | | X | | | X | |
| Drum Excavations | X | | X | X | | | X | | X | X | LEL - Rupture of a drum with a flammable liquid |
| Drum Sampling | | | | | | | X | | | X | |
| Technology Evaluation | | | | | | | | | | | |
| Air Stripping | X | | | X | | X | X | | | X | Thermal - Catalytic oven on air stripper |
| Soil Washing | X | X | X | X | | | X | | X | X | |
| Incineration | X | X | | X | | X | | | X | X | |
| Chemical Treatment | X | | | X | | | | | X | X | |
| Solidification | X | X | X | | X | | | | X | | |
| Dewatering | X | | X | X | X | | | | | X | |

[a] Radiation is site-specific and all tasks have the potential for exposure to radioactive materials. However, certain tasks have a higher probability of exposure to radiation hazards.

[b] Thermal hazards, such as heat stress, are dependent upon site temperature [Wet Bulb Globe Temperature (WBGT) >68°F], work load, and type of personal protective equipment (PPE). Conversely, cold stress is a concern at wind chill temperatures <37°F. These recommendations are from the American Conference of Governmental Industrial Hygienists (ACGIH).

[c] LEL - Lower explosive limit for fire and/or explosion.

# Hazard and Risk Analysis Matrix (cont.)

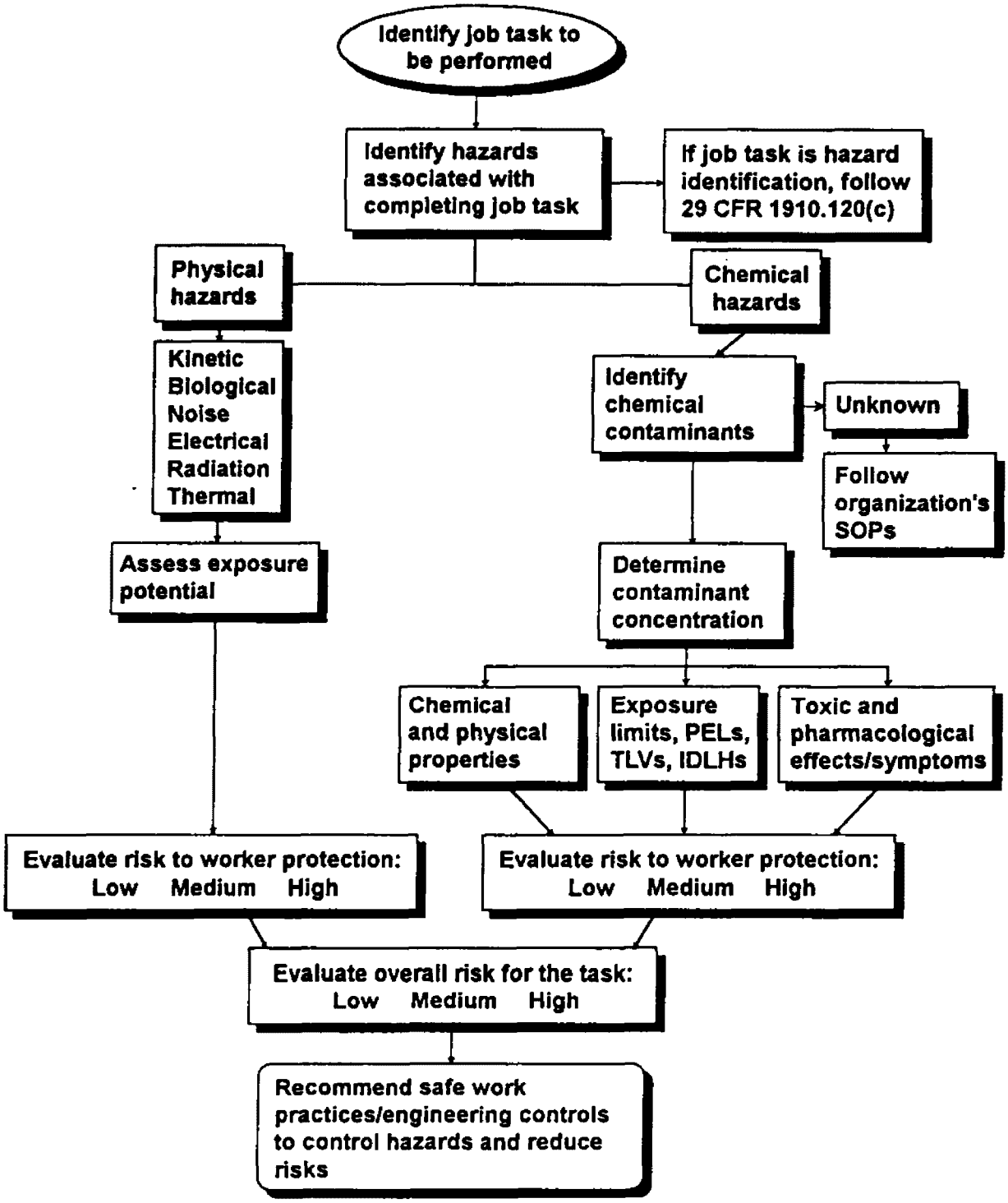
| TASKS | HAZARD CATEGORIES: KINETICS | BIOLOGICAL | NOISE | ELECTRICAL | RADIATION[a] | THERMAL[b] | LEL[c] | OXYGEN | REACTIVES | TOXICS | JUSTIFICATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Recontainerizing | X | | | | | | | | X | X | |
| Lab Pack Operations | X | | | | X | | | | X | X | |
| Liquid Transfer | X | | | | | | X | | X | X | |
| Solid Transfer | X | | | | | | | | X | X | |
| Material Bulking | X | | | | | | | | X | X | |
| Handling Compressed Gases | X | | | | | | X | | | X | |
| Detonation | X | | X | | | | X | | | X | |
| Remote Opening | X | | X | | | | X | | X | X | |
| Confined Space Entry | X | | | | X | | X | X | | X | Electrical - Lines within confined space |
| Tank Sampling | X | | | | X | | X | X | | X | |
| Tailings/Spoils Sampling | X | | | | X | | | | | X | Radiation - Tailings/spoils can be radioactive |
| Soil Gas Sampling | X | | | X | | | X | | | X | |
| Hydrological Monitoring | | | | | | | | | | | |
| Pump Tests | X | | X | X | | | | | | X | |
| Slug Tests | X | | | | | | | | | | |
| Dye Tests | X | | | | | | | | | | |
| Compatibility Testing | | | | | | | | | X | X | |
| Waste Treatment | X | X | | | X | | X | | X | X | |
| Drum Overpacking | X | | | | | | X | | X | X | Kinetic - Dropping a drum |
| UST Work | | | | | | | | | | | |
| Investigations | X | | | X | | | X | X | | X | |
| Corrective Actions | X | | | X | | | X | X | | X | |
| Decontamination and Decommission | X | X | | X | | | | | X | X | |

[a] Radiation is site-specific and all tasks have the potential for exposure to radioactive materials. However, certain tasks have a higher probability of exposure to radiation hazards.

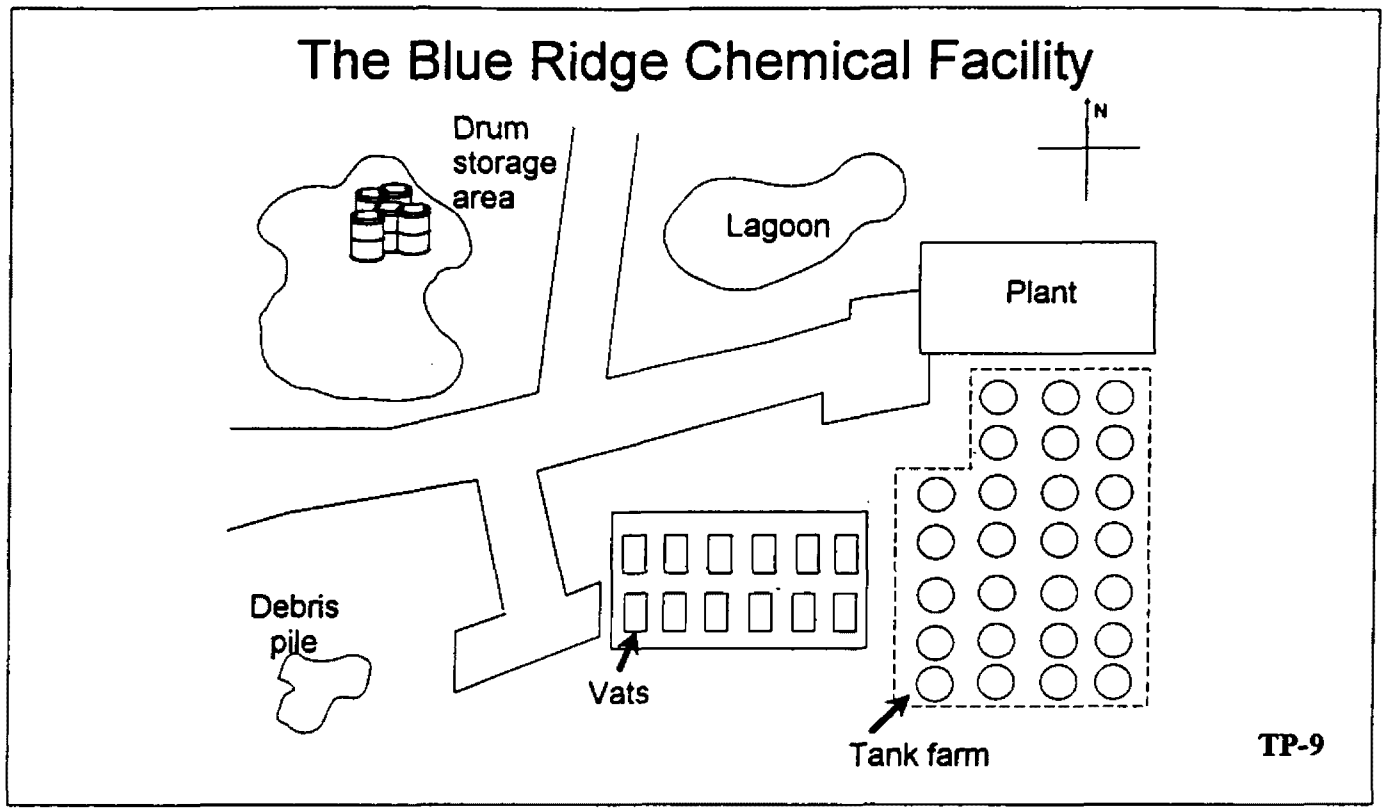
[b] Thermal hazards, such as heat stress, are dependent upon site temperature [Wet Bulb Globe Temperature (WBGT) >68°F], work load, and type of personal protective equipment (PPE). Conversely, cold stress is a concern at wind chill temperatures <37°F. These recommendations are from the American Conference of Governmental Industrial Hygienists (ACGIH).

[c] LEL = Lower explosive limit for fire and/or explosion.

# Hazard and Risk Analysis Flowchart




*Source:* U.S. DHHS 1985




Site description

The site is an abandoned chemical plant located in a rural east coast area. The area is residential, with a few industries located within the city limits. The facility is not currently secured. The facility manufactured specialty chemicals. Most of the process lines still have product in them. There are approximately 300 drums, 50 vertical tanks, 14 vats, and 1 lagoon onsite.

During your first reconnaissance, your team found two tanks with "Hydrazine (anhydrous)" stenciled on them. One of the tanks appears to be in bad condition: the shut-off valve is broken and there appears to be a material leaking from it into the containment basin.

Tasks to be performed

1. Characterize and identify the materials left onsite for disposal.
2. Build an earthen dike to prevent the material from spreading.

## Conclusion

- **Hazard and Risk Analysis**
- Air Monitoring Plans and Strategies
- Air Impact Assessments
- Personal Protective Equipment Decision-making

**TP-10**

### Crossword Puzzle

**Across**

7. Inhalation, ingestion, injection, and dermal are examples of _____ of exposure
8. The final goal of hazard and risk analysis is worker _____

**Down**

22. Most common category for accidents
23. An estimate of the likelihood that an event will occur

# APPENDIX

## Hazard and Risk Analysis Worksheets

# Worksheets for Case Study

**Safety Plan No.:** 177 **Site Name:** Blue Ridge Chemical Facility

Hazard Evaluation:

Waste Types: ____ Liquid ____ Solid ____ Sludge ____ Vapor

Characteristics: ____ Corrosive ____ Ignitable ____ Radioactive

____ Volatile ____ Toxic ____ Reactive

____ Unknown ____ Other: _____

Hazard Identification/Ranking (based on task and contaminant):

Task: _____ Low ____ Medium ____ High ____

Identification of hazards (chemical and physical):

Task: _____ Low ____ Medium ____ High ____

Identification of hazards (chemical and physical):

Hazard Assessment: _____

OVERALL HAZARD: ____ Serious ____ Moderate

____ Low ____ Unknown

**Safety Plan No.:** 177 **Site Name:** Blue Ridge Chemical Facility

*Make sure units are the same. ppm = $\frac{mg/m^3 \times 24.45}{\text{molecular weight}}$ = $\frac{mg/L \times 24,500}{\text{molecular weight}}$ (air)

ppm = mg/L (water)
ppm = mg/kg (soil)

| Hazardous/ Toxic Known or Suspected Materials | Concentration* | Media: Soil, Sediment, Surface water, or Groundwater | Toxic and Pharmacologic Effects | Ionization Potential (IP) or Vapor Pressure (VP) in air | *PELs, TLVs, IDLH | If concentration is >10 ppm in media, use NFPA Guidance for Flammability, Reactivity, and Special Notice | Applicable Monitoring Instruments for Health and Safety Screening |
|---|---|---|---|---|---|---|---|
| Asbestos<br>CAS # 1332-21-4 | Unknown | | Lungs - asbestosis | N/A | PEL: 0.2cc<br>TLV: Ca<br>IDLH: Ca | Flammability: N/A<br>Reactivity: N/A<br>Special Notice: N/A | Visual<br>MINIRAM® |
| Carbon tetrachloride<br>CAS # 56-23-5 | Unknown | | Cns. liver, kidneys<br>Skin irritant | IP=11.47 eV<br>VP=91mm | PEL: 10ppm<br>TLV:<br>IDLH 200ppm | Flammability: N/A<br>Reactivity: Yes<br>Special Notice: | HNU |
| Hydrazine<br>CAS # 302-01-2 | Unknown | | Irrit. eyes, nose, throat<br>kidney, edema | IP=8.93 eV<br>VP=10mm | PEL: 1 ppm<br>TLV:<br>IDLH: 50 ppm | Flammability: Yes<br>Reactivity: Yes<br>Special Notice: | CGI/$O_2$ meter<br>HNU |
| CAS # | | | | | PEL:<br>TLV:<br>IDLH: | Flammability:<br>Reactivity:<br>Special Notice: | |
| CAS # | | | | | PEL:<br>TLV:<br>IDLH: | Flammability:<br>Reactivity:<br>Special Notice: | |
| CAS # | | | | | PEL:<br>TLV:<br>IDLH: | Flammability:<br>Reactivity:<br>Special Notice: | |
| CAS # | | | | | PEL:<br>TLV:<br>IDLH: | Flammability:<br>Reactivity:<br>Special Notice: | |

# Sample Hazardous Substance Information Form

COMMON NAME: Hydrazine CHEMICAL NAME: _____

## I. PHYSICAL/CHEMICAL PROPERTIES

| | | | SOURCE |
|---|---|---|---|
| Natural physical state: (at ambient 20°–25°C) | Gas ____ Liquid X Solid ____ | | EAG[a] |
| Molecular weight | 32.05 | g/g-mole | EAG |
| Density | | g/ml | |
| Specific gravity | 1.008 @ 68 | °F/°C | EAG |
| Solubility: water | Miscible @ | °F/°C | EAG |
| Solubility: alcohol, ether | @ | °F/°C | |
| Boiling point | 236.3 | °F/°C | EAG |
| Melting point | 34.5 - 35.6 | °F/°C | EAG |
| Vapor pressure | 10-16 mm Hg @ 68 | °F/°C | EAG |
| Vapor density | | °F/°C | |
| Flash point (open cup X ; closed cup X ) | 100 @ | °F/°C | EAG |
| Other: _____ | | | |

## II. HAZARDOUS CHARACTERISTICS

| A. TOXICOLOGICAL HAZARD | HAZARD? | CONCENTRATIONS | SOURCE |
|---|---|---|---|
| Inhalation | Yes No | 0.03 ppm CA[b] | NIOSH Pocket Guide |
| Ingestion | Yes No | | NIOSH Pocket Guide |
| Skin/eye absorption | Yes No | | NIOSH Pocket Guide |
| Skin/eye contact | Yes No | | NIOSH Pocket Guide |
| Carcinogenic | Yes No | | NIOSH Pocket Guide |
| Teratogenic | Yes No | | |
| Mutagenic | Yes No | | |
| Aquatic | Yes No | | |
| Other: _____ | Yes No | | |

| B. TOXICOLOGICAL HAZARD | HAZARD? | CONCENTRATIONS | SOURCE |
|---|---|---|---|
| Combustibility | Yes No | With porous materials | NIOSH Pocket Guide |
| Toxic by-product(s): | Yes No | | |
| _____ | | Nitrogen oxides | EAG |
| _____ | | | |
| Flammability | Yes No | | |
| LFL | | 4.7% | EAG |
| UFL | | 98–100% | EAG |
| Explosivity | Yes No | | |
| LEL | | 2.9% | NIOSH Pocket Guide |
| UEL | | 98% | NIOSH Pocket Guide |

[a]EAG = Emergency Action Guides
[b]CA = carcinogen

| C. REACTIVE HAZARD | HAZARD? | CONCENTRATIONS | SOURCE |
|---|---|---|---|
| Reactivities: | (Yes) No | Metal oxides | EAG |
| | | Oxidizing agents | EAG |
| | | Porous materials | EAG |

| D. CORROSIVITY HAZARD | HAZARD? | CONCENTRATIONS | SOURCE |
|---|---|---|---|
| pH: | (Yes) No | | |
| Neutralizing agent: | | Very reactive with metallic oxides | EAG |

| E. RADIOACTIVE HAZARD | HAZARD? | CONCENTRATIONS | SOURCE |
|---|---|---|---|
| Background | Yes (No) | | |
| Alpha particles | Yes (No) | | |
| Beta particles | Yes (No) | | |
| Gamma radiation | Yes (No) | | |

III. DESCRIPTION OF INCIDENT:

Quantity involved 2 Tanks (Volume - unknown)

Release information leaking

Monitoring/sampling recommended

IV. RECOMMENDED PROTECTION:

Worker SCBA/fully encapsulating suit-butyl, natural rubber, PVC, Level A

Public

V. RECOMMENDED SITE CONTROL:

Hotline

Decontamination line

Command Post location

VI. REFERENCES FOR SOURCES:

NIOSH Pocket Guide

EAG

CHRIS manual

Condensed Chemical Dictionary

# Sample Hazardous Substance Information Form

COMMON NAME: Carbon tetrachloride CHEMICAL NAME: _____

## I. PHYSICAL/CHEMICAL PROPERTIES

| | | SOURCE |
|---|---|---|
| Natural physical state: (at ambient 20°–25°C) | Gas____ Liquid X Solid ____ | EAG[a] |
| Molecular weight | 153.8 g/g-mole | EAG |
| Density | g/ml | EAG |
| Specific gravity | 1.584 @ 68 (F)°C | EAG |
| Solubility: water (insoluble) | 0.08g/100g @ 68 (F)°C | EAG |
| Solubility: alcohol, benzene, ether | @ °F/°C | EAG |
| Boiling point | 170.2 (F)°C | EAG |
| Melting point | -8.7 to -9.4 (F)°C | EAG |
| Vapor pressure | 91.3 mm Hg @ 68 (F)°C | EAG |
| Vapor density | @ °F/°C | EAG |
| Flash point (open cup____; closed cup____) | N/A @ °F/°C | EAG |
| Other: _____ | | |

## II. HAZARDOUS CHARACTERISTICS

| A. TOXICOLOGICAL HAZARD | HAZARD? | CONCENTRATIONS | SOURCE |
|---|---|---|---|
| Inhalation | (Yes) No | 10 ppm | NIOSH Pocket Guide/EAG |
| Ingestion | (Yes) No | | NIOSH Pocket Guide/EAG |
| Skin/eye absorption | (Yes) No | Slightly | NIOSH Pocket Guide/EAG |
| Skin/eye contact | (Yes) No | | NIOSH Pocket Guide/EAG |
| Carcinogenic | (Yes) No | | NIOSH Pocket Guide/EAG |
| Teratogenic | Yes No | | |
| Mutagenic | Yes No | | |
| Aquatic | Yes No | | |
| Other: _____ | Yes No | | |

| B. TOXICOLOGICAL HAZARD | HAZARD? | CONCENTRATIONS | SOURCE |
|---|---|---|---|
| Combustibility | Yes (No) | | NIOSH Pocket Guide/EAG |
| Toxic by-product(s): | Yes (No) | | |
| _____ | | | NIOSH Pocket Guide/EAG |
| _____ | | | |
| Flammability | Yes (No) | | |
| LFL | | | NIOSH Pocket Guide/EAG |
| UFL | | | NIOSH Pocket Guide/EAG |
| Explosivity | Yes (No) | | |
| LEL | | | NIOSH Pocket Guide/EAG |
| UEL | | | NIOSH Pocket Guide/EAG |

[a]EAG = Emergency Action Guides

| C. REACTIVE HAZARD | HAZARD? | CONCENTRATIONS | SOURCE |
|---|---|---|---|
| Reactivities: | (Yes) No | Aluminum, calcium hypochlorite, magnesium, allyl alcohol, etc. | EAG |

| D. CORROSIVITY HAZARD | HAZARD? | CONCENTRATIONS | SOURCE |
|---|---|---|---|
| pH: | (Yes) No | | |
| Neutralizing agent: | | Iron and other metals in contact with water | EAG |

| E. RADIOACTIVE HAZARD | HAZARD? | CONCENTRATIONS | SOURCE |
|---|---|---|---|
| Background | Yes (No) | | |
| Alpha particles | Yes (No) | | |
| Beta particles | Yes (No) | | |
| Gamma radiation | Yes (No) | | |

III. DESCRIPTION OF INCIDENT:

Quantity involved 300 Drums

Release information

Monitoring/sampling recommended

IV. RECOMMENDED PROTECTION:

Worker

SCBA-viton®, nitrile, PVC blends suit (Level B)

Public

V. RECOMMENDED SITE CONTROL:

Hotline

Decontamination line

Command Post location

VI. REFERENCES FOR SOURCES:

NIOSH Pocket Guide

EAG

CHRIS manual

Condensed Chemical Dictionary

# Sample Hazardous Substance Information Form

COMMON NAME: Asbestos CHEMICAL NAME: _____

## I. PHYSICAL/CHEMICAL PROPERTIES

| | | | SOURCE |
|---|---|---|---|
| Natural physical state: (at ambient 20°–25°C) | Gas____ Liquid____ Solid X | | |
| Molecular weight | varies | g/g-mole | NIOSH Pocket Guide |
| Density | | g/ml | NIOSH Pocket Guide |
| Specific gravity | @ | °F/°C | NIOSH Pocket Guide |
| Solubility: water | @ | °F/°C | NIOSH Pocket Guide |
| Solubility: | Insoluble | °F/°C | NIOSH Pocket Guide |
| Boiling point | Decomposes | °F/°C | NIOSH Pocket Guide |
| Melting point | 1112°F | °F/°C | NIOSH Pocket Guide |
| Vapor pressure | NA | °F/°C | NIOSH Pocket Guide |
| Vapor density | NA | °F/°C | NIOSH Pocket Guide |
| Flash point (open cup____; closed cup____) | NA | °F/°C | NIOSH Pocket Guide |
| Other: _____ | | | |

## II. HAZARDOUS CHARACTERISTICS

| A. TOXICOLOGICAL HAZARD | HAZARD? | CONCENTRATIONS | SOURCE |
|---|---|---|---|
| Inhalation | (Yes) No | 0.5 fibers/cc | CCD[a] |
| Ingestion | Yes No | | |
| Skin/eye absorption | Yes No | | |
| Skin/eye contact | Yes No | | |
| Carcinogenic | (Yes) No | 0.5 fibers/cc | CCD |
| Teratogenic | Yes No | | |
| Mutagenic | Yes No | | |
| Aquatic | Yes No | | |
| Other: _____ | Yes No | | |

| B. TOXICOLOGICAL HAZARD | HAZARD? | CONCENTRATIONS | SOURCE |
|---|---|---|---|
| Combustibility | Yes (No) | | NIOSH Pocket Guide |
| Toxic by-product(s): | Yes (No) | | |
| _____ | | | NIOSH Pocket Guide |
| _____ | | | NIOSH Pocket Guide |
| Flammability | Yes (No) | | |
| LFL | | | NIOSH Pocket Guide |
| UFL | | | NIOSH Pocket Guide |
| Explosivity | Yes (No) | | |
| LEL | | | NIOSH Pocket Guide |
| UEL | | | NIOSH Pocket Guide |

[a]CCD = Condensed Chemical Dictionary

| C. REACTIVE HAZARD | HAZARD? | CONCENTRATIONS | SOURCE |
|---|---|---|---|
| Reactivities: | Yes (No) | | NIOSH Pocket Guide |
| | | | NIOSH Pocket Guide |
| | | | NIOSH Pocket Guide |

| D. CORROSIVITY HAZARD | HAZARD? | CONCENTRATIONS | SOURCE |
|---|---|---|---|
| pH: | Yes (No) | | |
| Neutralizing agent: | | | NIOSH Pocket Guide |
| | | | NIOSH Pocket Guide |

| E. RADIOACTIVE HAZARD | HAZARD? | CONCENTRATIONS | SOURCE |
|---|---|---|---|
| Background | Yes (No) | | NIOSH Pocket Guide |
| Alpha particles | Yes (No) | | NIOSH Pocket Guide |
| Beta particles | Yes (No) | | NIOSH Pocket Guide |
| Gamma radiation | Yes (No) | | NIOSH Pocket Guide |

III. DESCRIPTION OF INCIDENT:

Quantity involved **Unknown amount in debris piles**

Release information

Monitoring/sampling recommended

IV. RECOMMENDED PROTECTION:

Worker **Tyvek® with air-purifying respirators (APRs) that have HEPA filters**
**NIOSH Pocket Guide recommends SCBA - pressure demand**

Public

V. RECOMMENDED SITE CONTROL:

Hotline

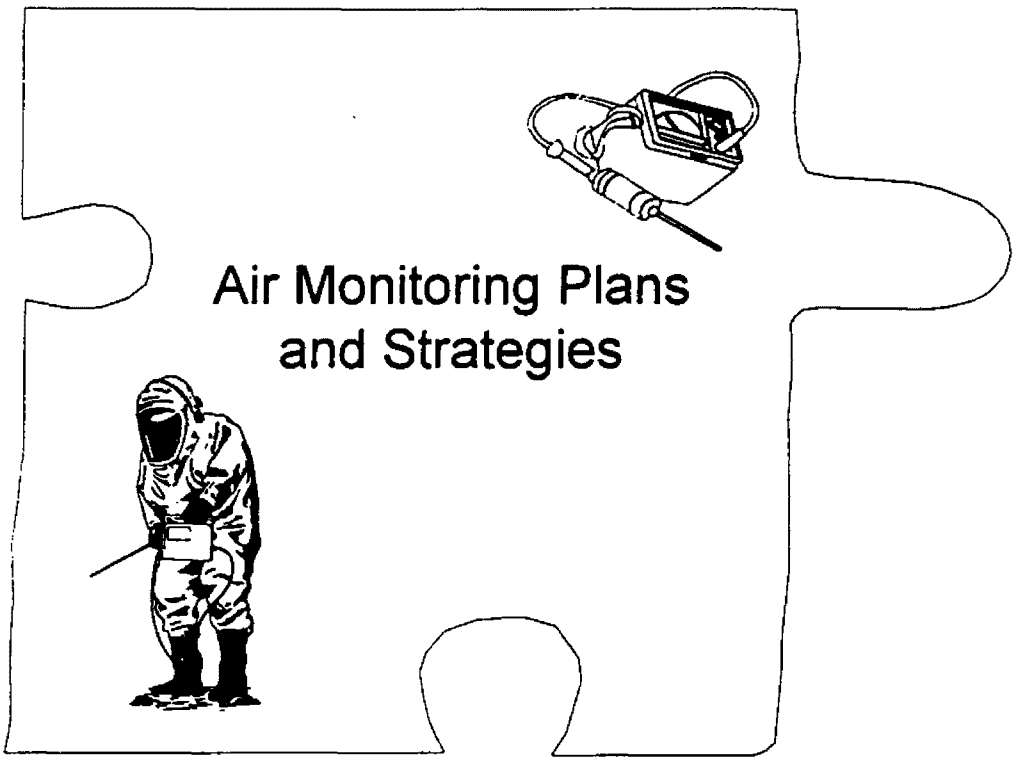
Decontamination line

Command Post location

VI. REFERENCES FOR SOURCES:

NIOSH Pocket Guide
EAG
CHRIS manual
Condensed Chemical Dictionary

# AIR MONITORING PLANS AND STRATEGIES




TP-1

## *Module Goals:*

The student goals for this module are:

1. Given available published technical references, identify air monitoring and air sampling equipment.

2. Given the U.S. Environmental Protection Agency (EPA) Standard Operating Safety Guides (SOSGs), develop standard operating procedures (SOPs) for air monitoring and air sampling.

3. Given 29 CFR 1910.120 and available published technical references, select the type of air surveillance instrumentation that can be used to characterize a hazardous waste site.

Given available technical references, differentiate between air monitoring and air sampling.

"OSHA does not define the term air monitoring. Rather, OSHA uses this term to refer to both monitoring using _____-_____ instrumentation and to __ _____ using personal sampling pumps or other quantitative methods. However, in this fact sheet, the term 'air monitoring' refers to the use of direct-reading instruments (DRIs) producing instantaneous data, while the term 'air sampling' refers to the use of a sampling pump and collection media that produce samples that must be sent to a laboratory for further analysis."

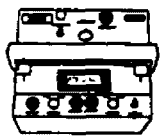
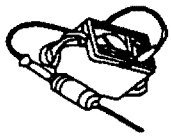
*Source:* PASAMR Fact Sheet (U.S. EPA 1993) **TP-2**

| Examples of Air Monitoring Instruments | Examples of Air Sampling Instruments |
|---|---|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

Air surveillance = Air_____ and/or air _____

Given available published technical references, select air monitoring equipment for immediately dangerous to life or health (IDLH) conditions.

Draw a line from each instrument to its name and corresponding IDLH condition.

| Instrument | | Name | IDLH |
|---|---|---|---|
| 1. |  | Radiation meter | |
| 2. | | Combustible gas indicator | $\pm O_2$ |
| 3. |  | Oxygen meter | |
| 4. | | Toxic monitor | |

TP-3

## Sample Bag Readings

Lower explosive limit (LEL) (%) _____

Oxygen deficiency (%) _____

Radiation (mR/h) _____

Toxicity (metered units, ppm?) _____

Potential IDLH condition(s) = _____

TP-4

Given available published technical references, select air sampling equipment by determining the volatility of compounds.

Volatility is based on vapor pressure (VP):

| | | |
|---|---|---|
| | V = Volatile | VP ≥1 mm |
| | SV = Semivolatile | VP = $10^{-7}$ to 1 mm |
| | NV = Nonvolatile | VP <$10^{-7}$ mm |

| Compounds | Page # in NIOSH Pocket Guide | Answers | |
|---|---|---|---|
| | | V, SV, NV | VP (mm Hg) |
| Aldrin | 8 | | 0.00008 |
| Ammonia | 14 | | >1 atm |
| Asbestos | 22 | | 0 |
| Benzidine | 26 | | Low |
| Carbon tetrachloride | 54 | | 91 |
| Diphenyl (PCB) | 120 | | 0.005 |
| Hydrazine (anhydrous) | 166 | | 10 |
| Lead | 184 | | 0 |
| Sodium hydroxide | 284 | | 0 |
| | | | TP-5 |

Given available published technical references, match air sampling equipment to the contaminant category.

1. Circle all equipment in the first column that applies to volatiles.
2. Circle all equipment in the second column that applies to semivolatiles.
3. Circle all equipment in the third column that applies to nonvolatiles.

| Volatiles | Semivolatiles | Nonvolatiles |
|---|---|---|
| Filters | Filters | Filters |
| Impingers | Impingers | Impingers |
| Solid sorbent tubes | Solid sorbent tubes | Solid sorbent tubes |
| Cyclones | Cyclones | Cyclones |
| Summa canister | Summa canister | Summa canister |
| Passive dosimeters | Passive dosimeters | Passive dosimeters |
| Combination | Combination | Combination |
| Aerosol monitor | Aerosol monitor | Aerosol monitor |

Given EPA SOSGs, list six objectives of air surveillance.

## Six Objectives of Air Surveillance

1. _____ and quantify airborne contaminants onsite and offsite.
2. Track changes in air contaminants that occur over the _____ of the incident.
3. Ensure proper _____ of work practices and engineering controls.

TP-6

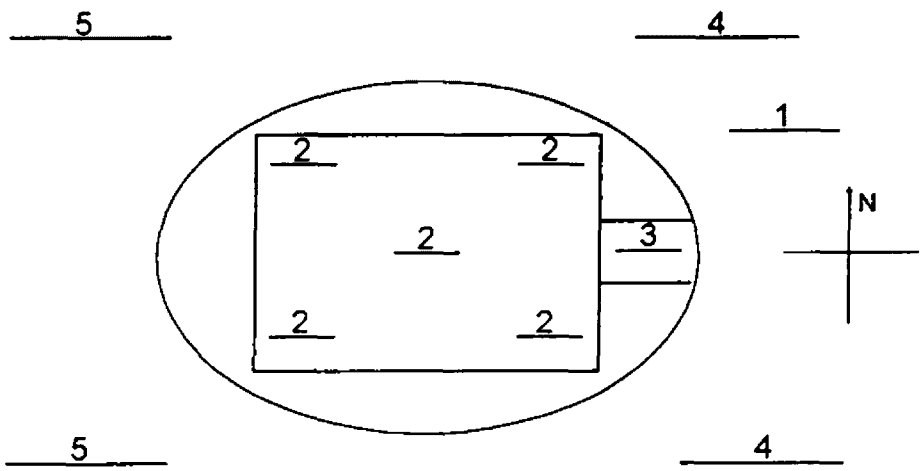
## Six Objectives of Air Surveillance (cont.)

4. Determine the level of worker_____ needed.
5. Assist in defining work_____ .
6. Identify additional_____ monitoring needs in any given area of the site.

TP-7

Given EPA SOSGs and a hazardous waste site, identify five areas onsite where air sampling is performed.

## Work Zones on a Hypothetical Hazardous Waste Site




1-Command Post
2-Contaminated or Hot Zone
3-Decontamination Zone
4-Upwind
5-Downwind
Wind Direction

**TP-8**

Given one of the five areas where air sampling is performed on a hazardous waste site, state a reason for air sampling at that location.

1. Command post - _____

2. Contaminated or hot zone - _____

3. Decontamination zone - _____

4. Upwind - _____

5. Downwind - _____

Given EPA SOSGs and the six objectives of air surveillance, determine the type of air surveillance needed by defining perimeter monitoring, personal monitoring, and periodic monitoring.

**Perimeter monitoring**

S-1

- Refers to fixed-location monitoring at the _____ or perimeter, where PPE is no longer required.
- Measures contaminants moving _____ from the site.
- Enables the site Health and Safety _____ to assess clean areas.
- Requires wind speed and wind direction data for interpretation of results from a _____-location sample.

**Personal monitoring**

S-2

- Performed during actual cleanup phase to evaluate ____-___ employees (i.e., employees likely to have the highest exposure).
  - Evaluation of other employees may be needed if high-risk employees exceed _____ limits.

**Periodic monitoring**

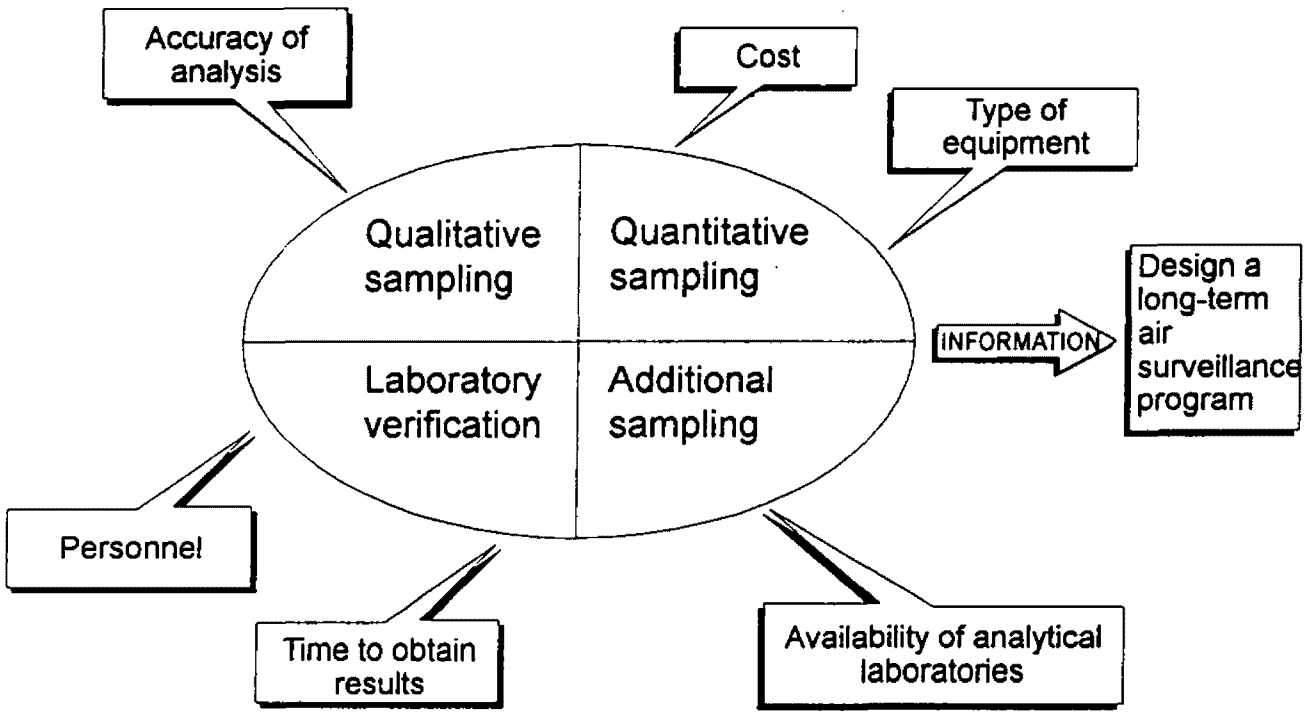
S-3

- "Periodic monitoring (_____) be done when the possibility of a dangerous condition has developed or when there is reason to believe that _____ may have risen above PELs since prior monitoring was conducted."

*Source:* SOSGs (U.S. EPA 1992)

Given EPA SOSGs, identify four components that should be considered before implementing a long-term air surveillance program.

## Long-term Air Surveillance Program Considerations



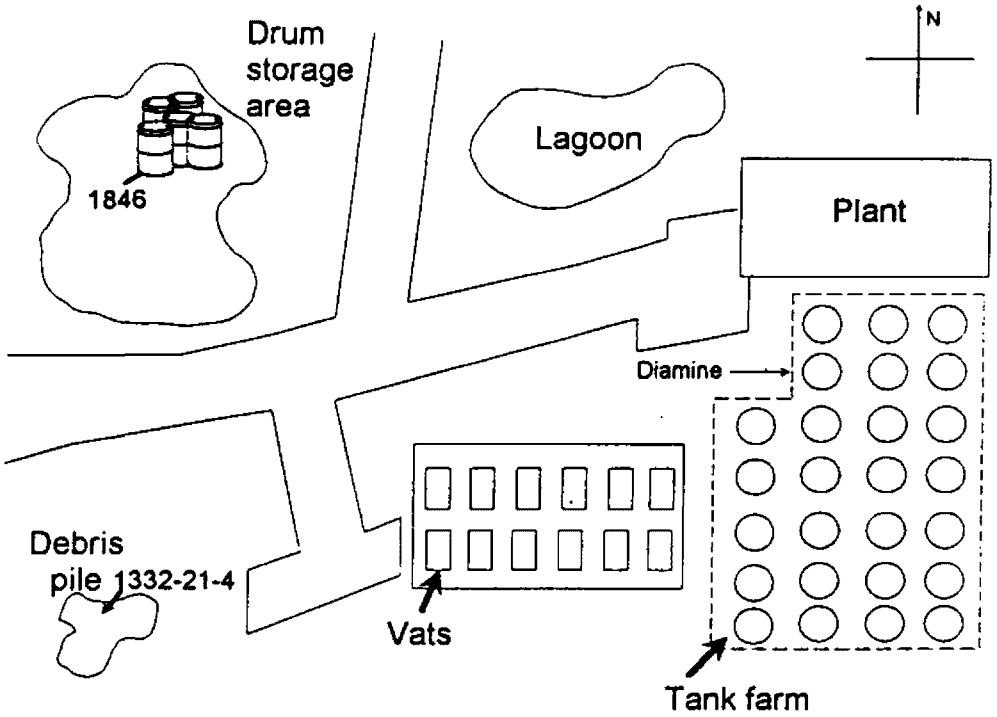

TP-9

Given 29 CFR 1910.120, available published technical references, and conditions on a hazardous waste site:

- Select a method to identify and analyze a specific contaminant.

1. List at least four organizations that have developed methods to identify and analyze a specific contaminant.

# The Blue Ridge Chemical Facility




TP-10

| Weather Conditions | | Chemical Conditions |
|---|---|---|
| Temperature _____ | Wind speed _____ | Drum storage area _____ |
| Humidity _____ | Wind direction _____ | Debris pile _____ |
| Barometric pressure _____ | Cloud cover _____ | Tank farm _____ |

1. What compound is in the drum storage area? In the debris pile? In the tank farm? _____

2. What air monitoring instruments would you use in the drum storage area? In the debris pile? In the tank farm? _____

3. What computer resource program could be used to select a method for sampling the three identified compounds onsite? _____

## Word Search

Find the following terms:

| | | | |
|---|---|---|---|
| AIR MONITORING | FID | NAOH | PERIODIC |
| AIR SAMPLING | HYDRAZINE | NONVOLATILE | PID |
| AMMONIA | IDLH | ORGANIC | RADIATION |
| CGI | LAB RESULTS | OXYGEN METER | SEMIVOLATILE |
| CYCLONE | LEAD | PERIMETER | SOP |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | A | O | H | Z | E | N | O | L | C | Y | C | A |
| A | P | X | Y | D | L | S | T | B | M | R | V | I |
| S | E | Y | D | C | I | D | O | I | R | E | P | R |
| T | R | G | R | U | T | D | W | P | O | S | K | S |
| L | I | E | A | W | A | G | L | U | D | I | P | A |
| U | M | N | Z | F | L | S | M | H | C | A | G | M |
| S | E | M | I | V | O | L | A | T | I | L | E | P |
| E | T | E | N | N | V | I | X | S | N | T | D | L |
| R | E | T | E | J | N | R | E | C | A | J | B | I |
| B | R | E | T | O | O | Q | F | Z | G | U | Y | N |
| A | I | R | M | O | N | I | T | O | R | I | N | G |
| L | D | M | N | H | D | R | G | P | O | W | C | E |
| M | A | Z | F | R | A | D | I | A | T | I | O | N |

# Conclusion

- Hazard and Risk Analysis
- **Air Monitoring Plans and Strategies**
- Air Impact Assessments
- Personal Protective Equipment Decision-making

**TP-11**

## Crossword Puzzle

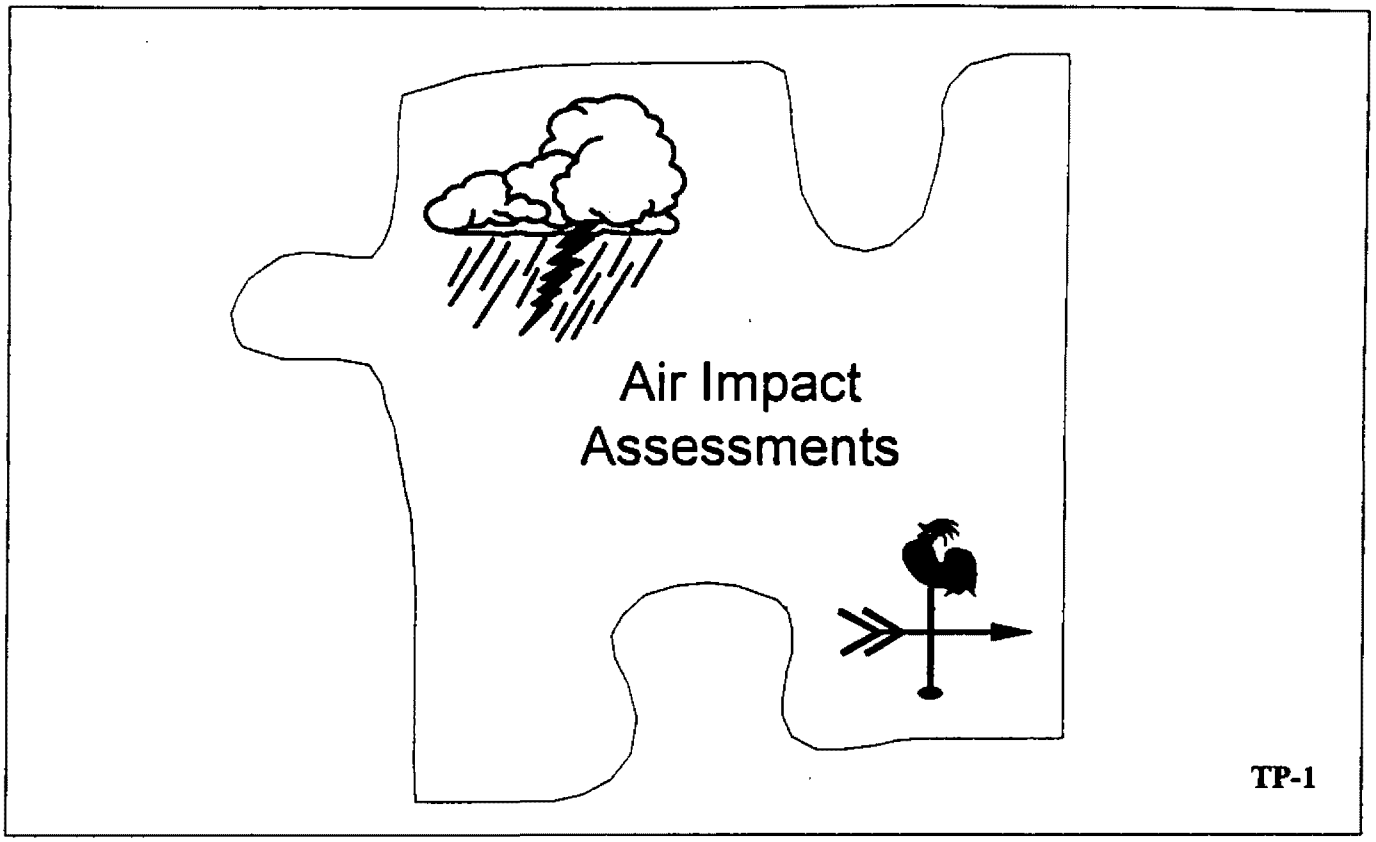
**Across**

10. Aldrin is a compound that has a low _____ pressure
19. Tenax® is a type of solid _____ tube for collecting air samples
39. The PID, FID, CGI, and radiation meters are examples of ____s (acronym)

**Down**

35. Combustible gas indicators measure %____ of a flammable gas (acronym)

# AIR IMPACT ASSESSMENTS




## *Module Goal:*

The student goal for this module is:

Given the National Technical Guidance Study (NTGS) Series, Volume I, and conditions found on a hazardous waste site, determine the need for an air impact assessment (AIA).

Given NTGS, Volume I, define an AIA.

## Air Impact Assessment

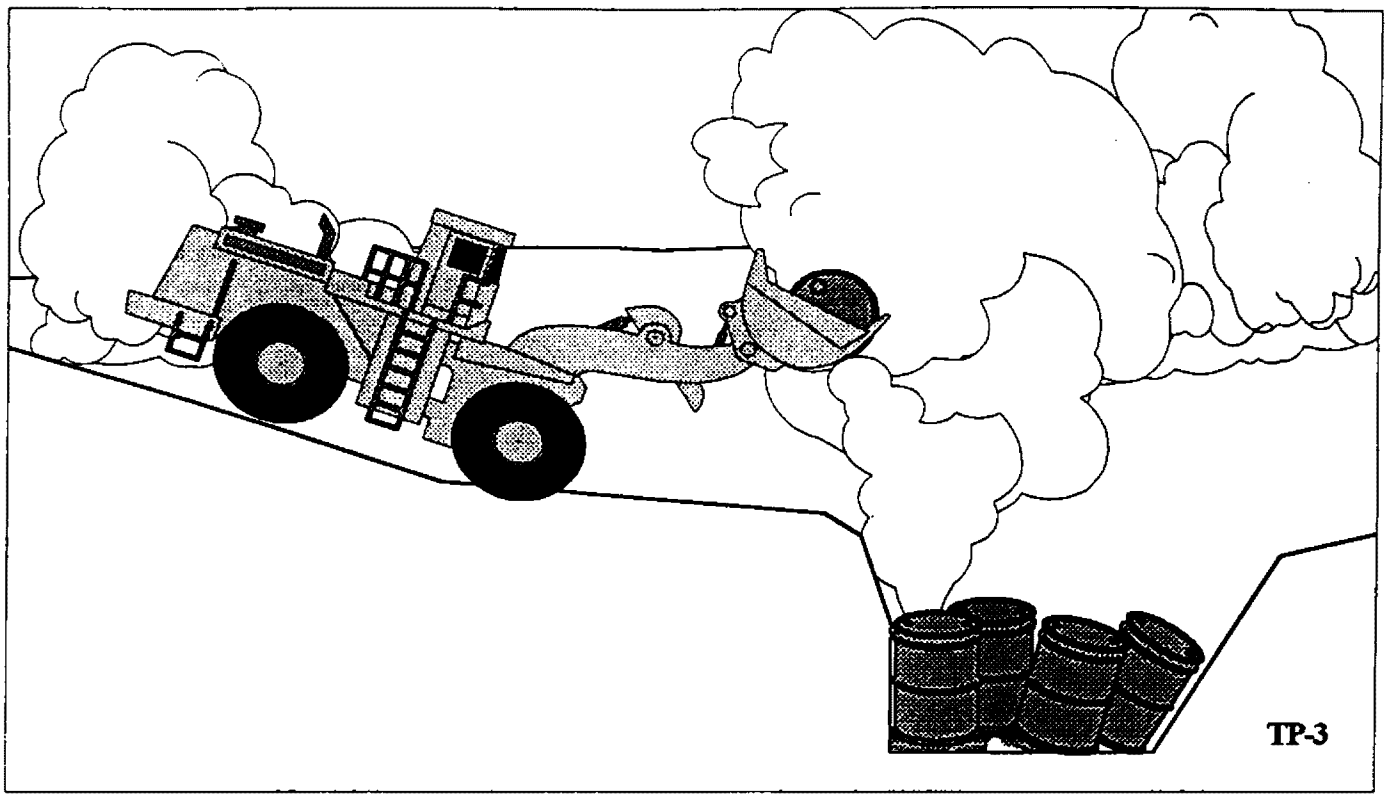
A systematic _____ of the potential or actual effects of an emission source on air quality.

These effects impact site _____, surrounding populations, and/or the environment.

TP-2

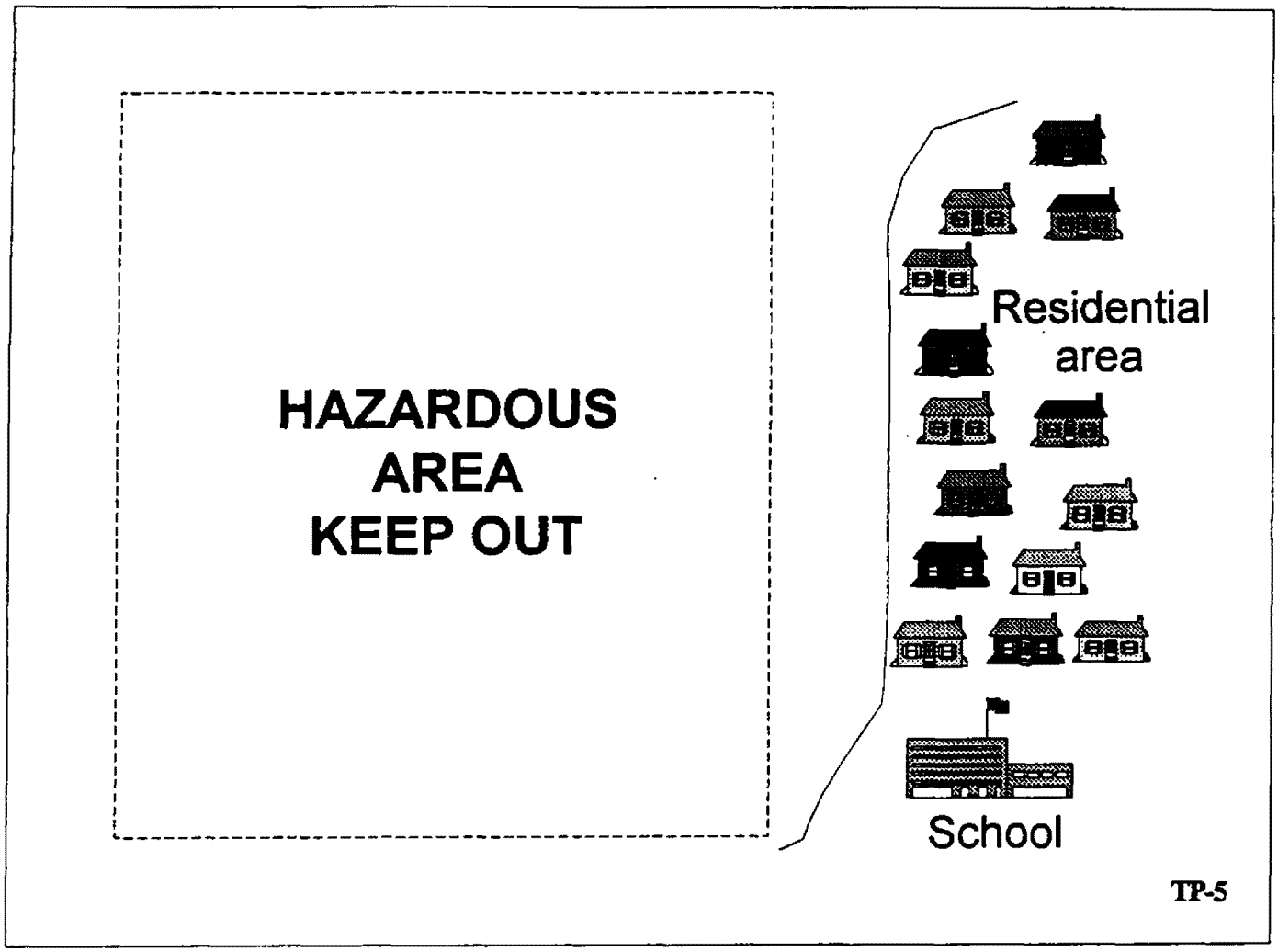
List the reasons why an AIA may be important for a Superfund site:

1.
2.
3.
4.
5.
6.



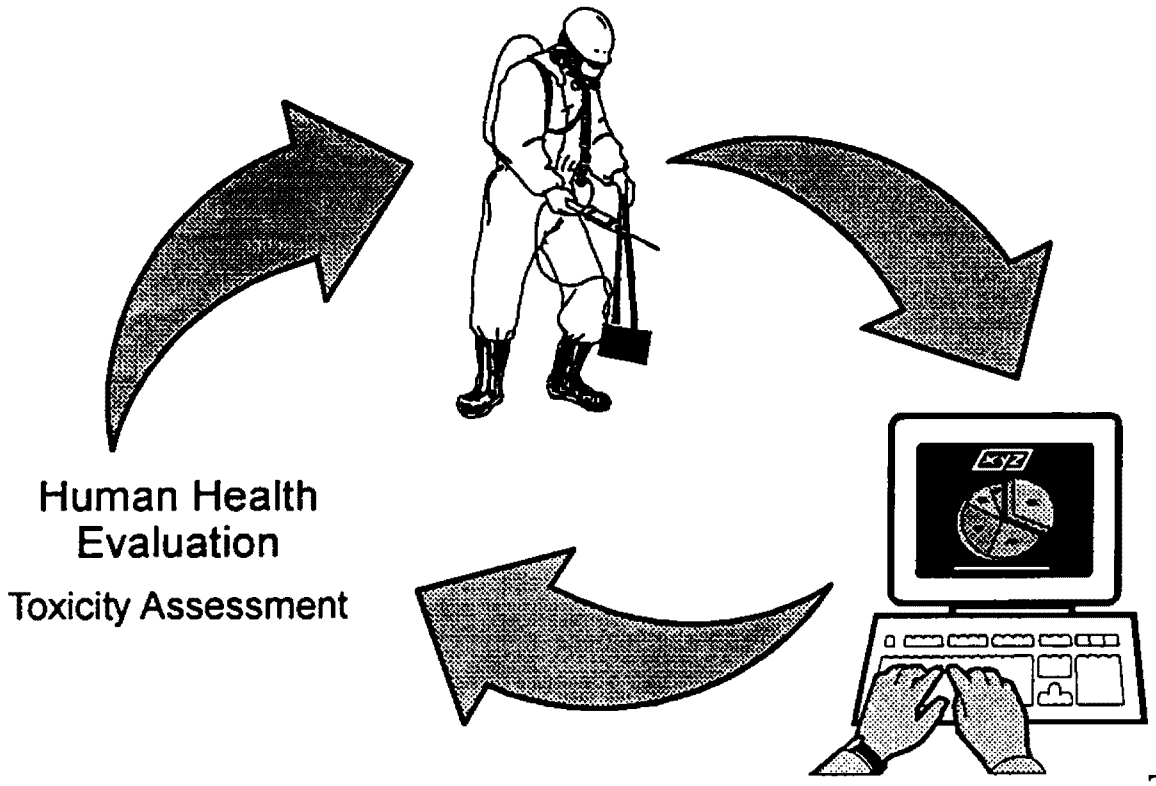
TP-3

TP-4


HAZARDOUS
AREA
KEEP OUT
Residential
area
School
TP-5

Given NTGS, Volume I, list the three components of an AIA.

## Components of an AIA



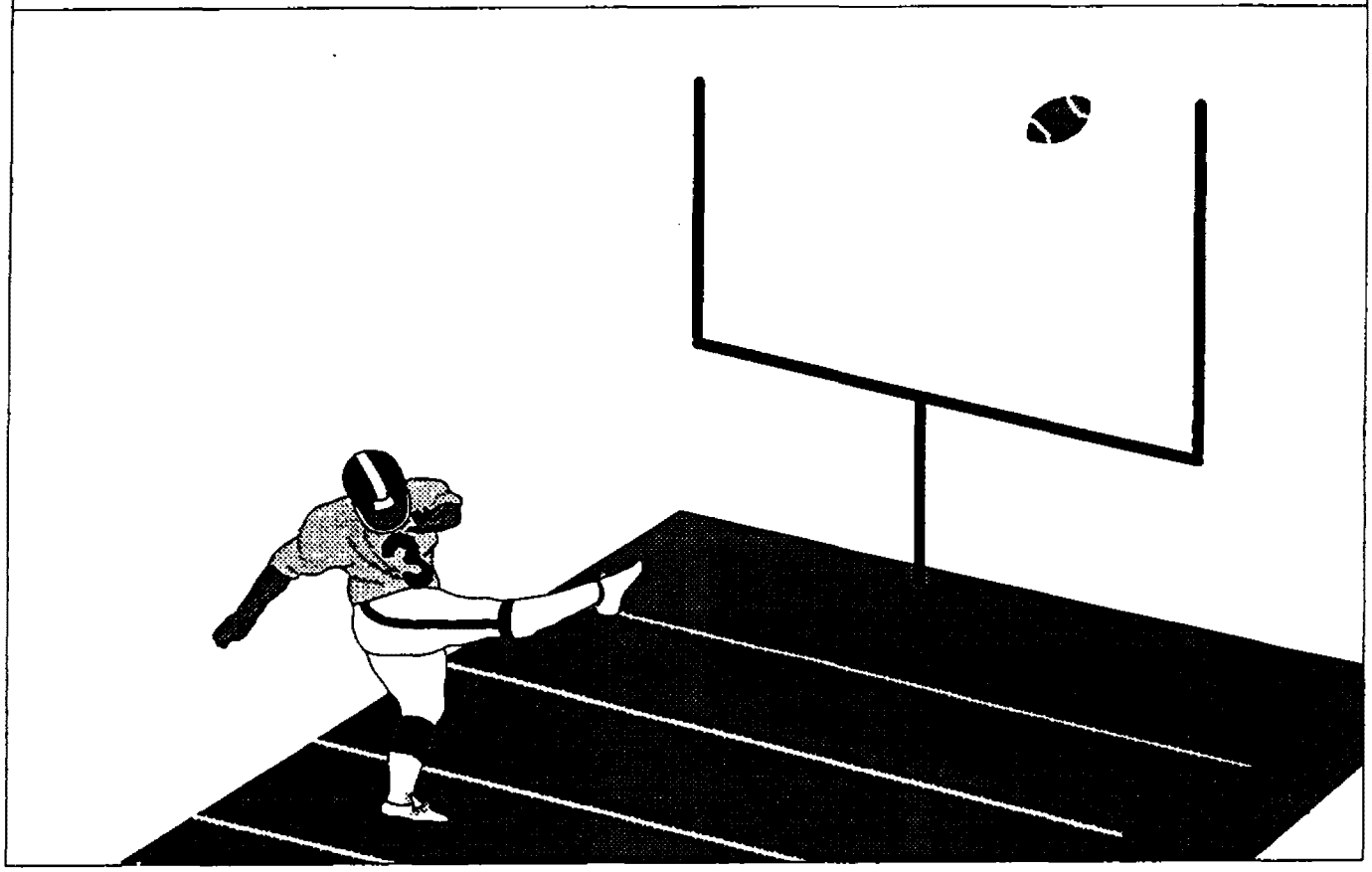

TP-6

There are three components of an AIA. They are:

1. Monitoring and sampling
2. Modeling
3. Risk assessment

Given NTGS, Volume I, list the three goals of an AIA.

## Goals of an AIA



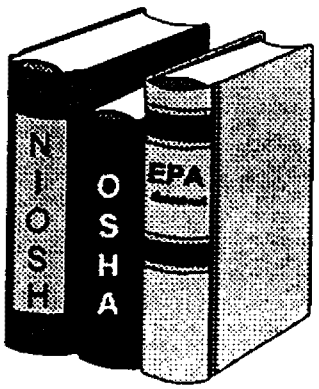
The three goals of an AIA are to evaluate:

1. The exposure of _____.

2. The exposure of ___ _____.

3. _____ impacts.

# Review of Technical References




## Onsite

Air action limits or air exposure limits based on:

- Permissible exposure limits (PELs) — OSHA
- Recommended exposure limits (RELs) — NIOSH
- Immediately dangerous to life or health (IDLH) concentrations — NIOSH
- Threshold Limit Values (TLVs) — ACGIH
- Standard Operating Safety Guides (SOSGs) — EPA

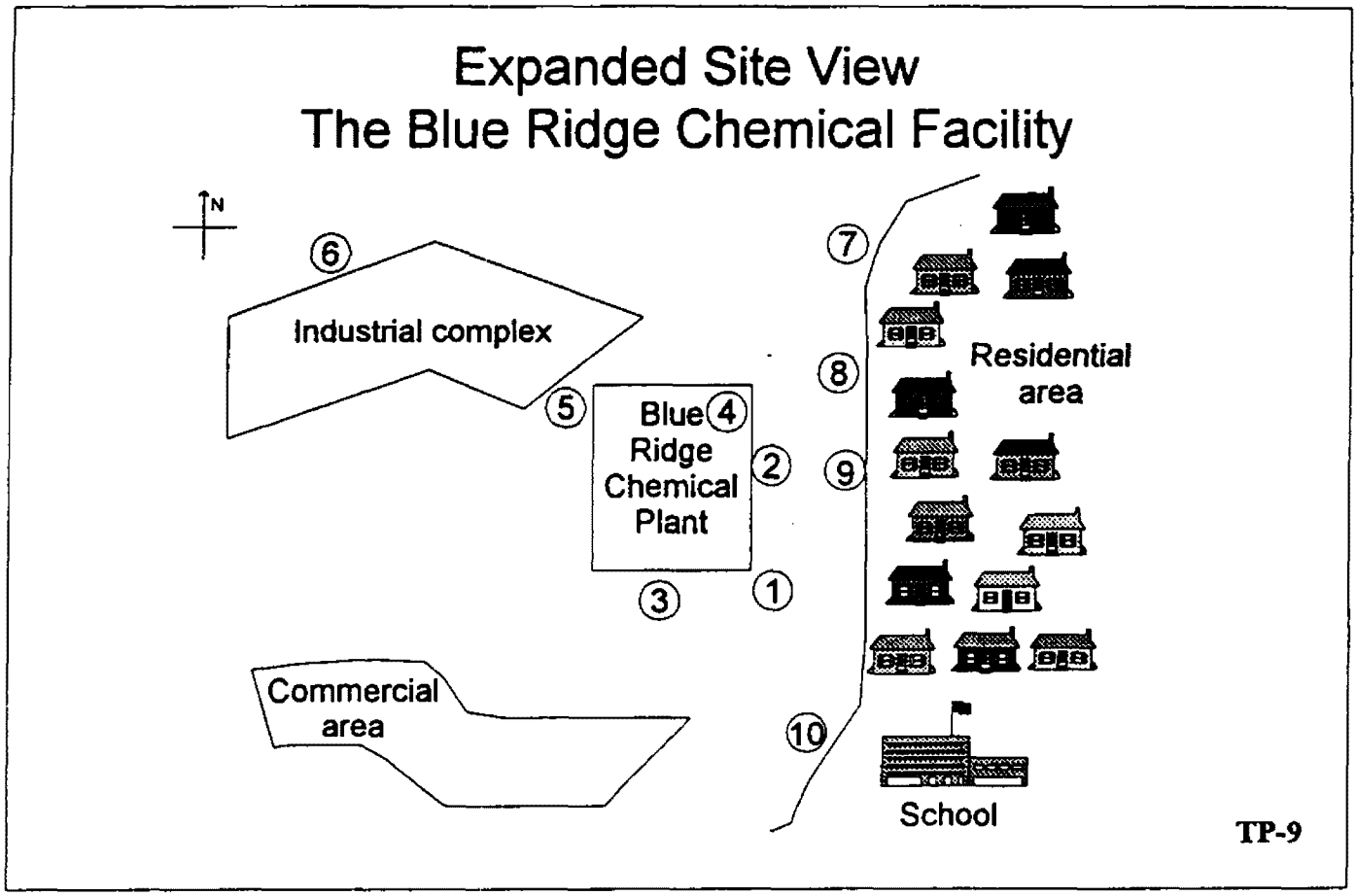
## Offsite

Air action limits or air exposure limits based on:

- National ambient air quality standards (NAAQS)
- Applicable or relevant and appropriate requirements (ARARs)

TP-8

Given available published technical references and data from the case study, compare site air monitoring data to established air action levels and regulations.




| CHEMICAL | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Asbestos (fibers/cm³) | ND* | ND | <0.2 | ND | ND | ND | ND | ND | ND | ND |
| Carbon tetrachloride (ppm) | 1 | 0.5 | 0.3 | 4 | ND | ND | ND | ND | ND | ND |
| Hydrazine (ppm) | 3 | 0.1 | 0.1 | ND | ND | ND | ND | 0.01 | ND | ND |
| *ND = None detected | Onsite Sample Locations | | | | | Offsite Sample Locations | | | | |

What air action levels and/or regulations can be used for onsite workers? _____

_____

Given NTGS, Volume I, and available published technical references, determine the need for offsite air monitoring by identifying populations at risk and exceedance of offsite air action levels.

Case Study Exercise

Answer the following questions using the data given to you.

1. Should an AIA be completed for this site (yes or no)? Why or why not?

_____

_____

_____

2. Should we be concerned about the potential exposure of the offsite populace (yes or no)? Please support your answer.

_____

_____

_____

3. What chemical(s) is/are a possible concern with offsite receptors?

_____

4. Are there any air action levels established for offsite receptors?

_____

5. Do we need to establish air action levels for the offsite populace?

_____

_____

_____

## Conclusion

- Safety and Health Compliance with 29 CFR 1910.120
- Safety and Health Construction Standards
- Toxic and Hazardous Substances Standards
- Safety and Health Program, Paragraph (b)
- Hazard and Risk Analysis
- Air Monitoring Plans and Strategies
- **Air Impact Assessments**
- Personal Protective Equipment Decision-making

**TP-10**

### Crossword Puzzle

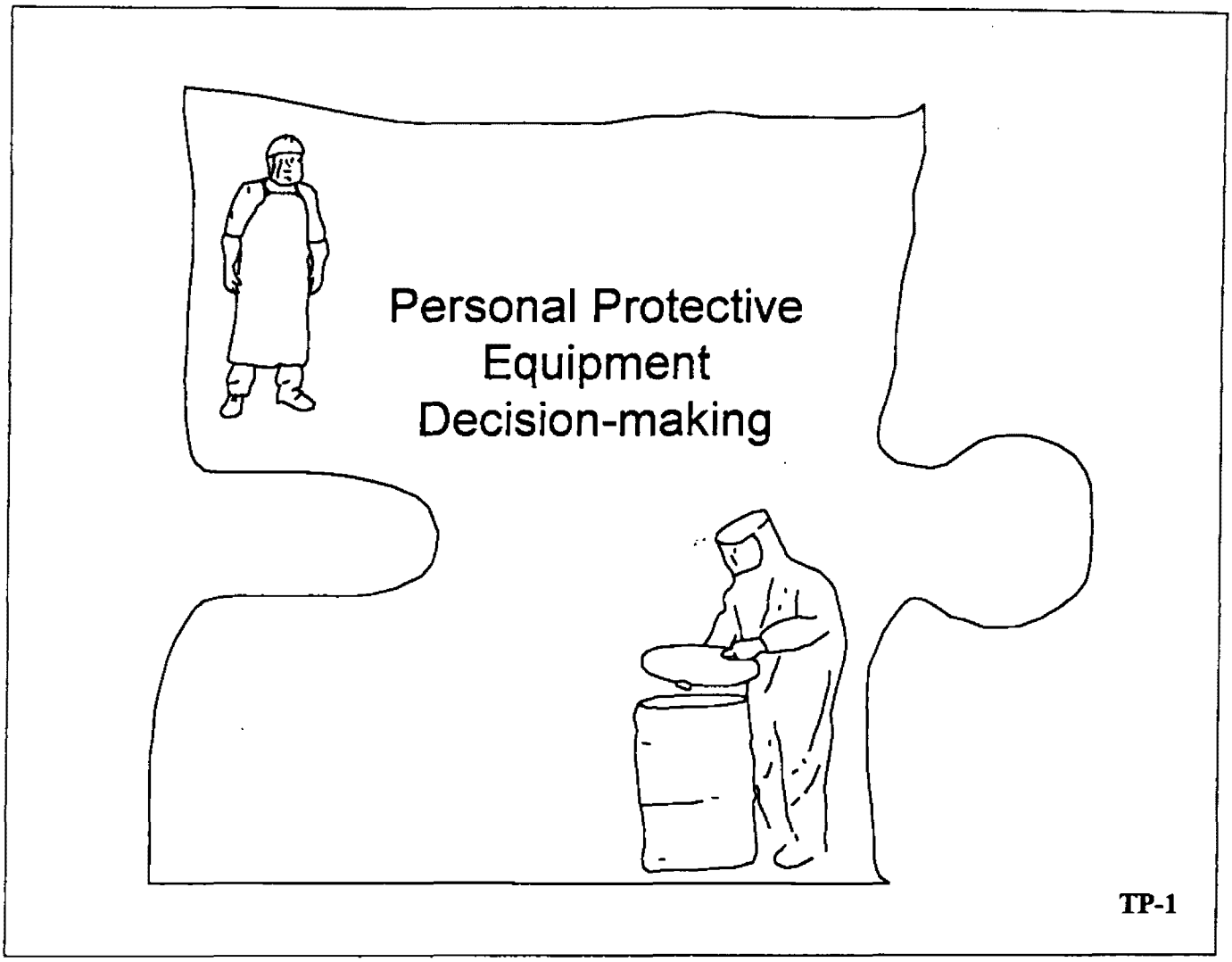
**Across**

43. One of the three components of an AIA is _____

**Down**

12. An environmental exposure term (acronym)
15. One of the goals of an AIA is to evaluate _____ impacts
16. One reason an AIA is important is that it reduces ____

# PERSONAL PROTECTIVE EQUIPMENT DECISION-MAKING




## *Module Goals:*

The student goals for this module are:

1. Given 29 CFR 1910.120(g)(5) and U.S. Environmental Protection Agency (EPA) Standard Operating Safety Guides (SOSGs), develop a personal protective equipment (PPE) program.

2. Given conditions at a hazardous waste site, available published technical references, and an organizational PPE program, choose PPE to reduce and maintain worker exposure at or below permissible exposure limits (PELs) or published exposure limits.

Given 29 CFR 1910.120(g)(5) and an organization's safety and health program, identify the PPE program components.

## Hierarchy of Controls

- Engineering
- Work practices
- PPE

*Source:* 29 CFR 1910.120(g)

**TP-2**

# PPE Regulations

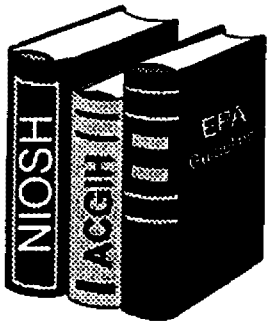
- Hazardous Waste Operations and Emergency Response
  - 29 CFR 1910.___
- General Requirements for Personal Protective Equipment
  - 29 CFR 1910.___
- Eye and Face Protection
  - 29 CFR 1910.____
- Standard Practice for Respiratory Protection
  - 29 CFR 1910.___
- Head Protection
  - 29 CFR 1910.___
- Safety Toe Footwear
  - 29 CFR 1910.___

TP-3

Other References

1. General PPE: _____
2. Eye and Face Protection: _____
   _____
3. Respiratory Protection: _____
   _____
4. Head Protection: _____
   _____
5. Safety Toe Footwear: _____

# PPE References




- Chemical clothing manufacturers' permeation data sheets
- Certified Equipment Listing — National Institute for Occupational Safety and Health (NIOSH)
- Quick Selection Guide to Chemical Protective Clothing
- SOSGs — U.S. EPA

TP-4

# Minimum Elements of a PPE Program
# 29 CFR 1910.120(g)(5)

- PPE selection based on site hazards
- PPE use and equipment limitations
- Work mission and duration
- PPE maintenance and storage
- PPE decontamination and disposal

TP-5

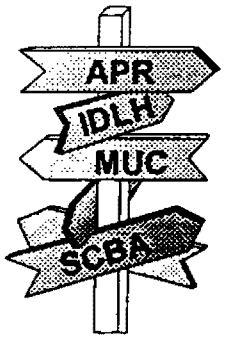
## Minimum Elements of a PPE Program
## 29 CFR 1910.120(g)(5) (cont.)

- PPE training and proper fitting
- PPE donning and doffing procedures
- PPE inspection procedures
- Evaluation of program effectiveness
- Limitations resulting from temperature extremes and other medical considerations

**TP-6**

# Respiratory Protection
# 29 CFR 1910.134

Minimum requirements for a respiratory protection program:

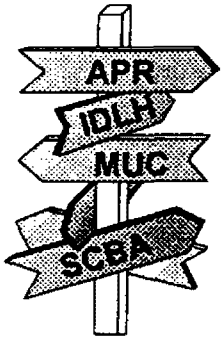



- Standard operating procedures
- Selection of respirators based on hazards
- Training in proper use and limitations of respirators
- Cleaning and disinfection
- Storage

TP-7

# Respiratory Protection
# 29 CFR 1910.134 (cont.)

Minimum requirements for a respiratory protection program:




- Inspection during cleaning of respirators
- Monitoring of area conditions and employee exposure
- Program evaluation
- Medical clearance for persons using respirators
- Use of approved respirators

TP-8

## Air-purifying Respirator (APR) Selection Criteria

- Sufficient oxygen (19.5 percent minimum)
- Physical and chemical properties of the contaminants
- Respirator approvals (NIOSH, MSHA)
- Sorbent limitations
- Warning properties
- Air monitoring data
- Respiratory protection factors
- Fit testing
- Physiological and psychological limits

TP-9

APR Limitations

1.

2.

3.

4.

5.

## Supplied-air Respirator (SAR) Selection Criteria

- Air contaminants are unknown.
- Air contaminants have been identified and the MUCs for APRs are not met.
- Immediately dangerous to life and health (IDLH) air concentrations are present.
- The atmosphere contains less than 19.5 percent oxygen.
- An emergency situation exists.
- Criteria for APR use are not met.

TP-10

# Respirator Decision Logic

Identify the following information:

- General use conditions
  - Physical, chemical, and toxicological properties
- Warning properties and concentrations
- Exposure limits
- IDLH concentrations
- Eye irritation information (not necessary for EPA sites)
- Respirator service life information

*Source:* NIOSH Respirator Decision Logic (U.S. DHHS 1987) **TP-11**

## Notes:

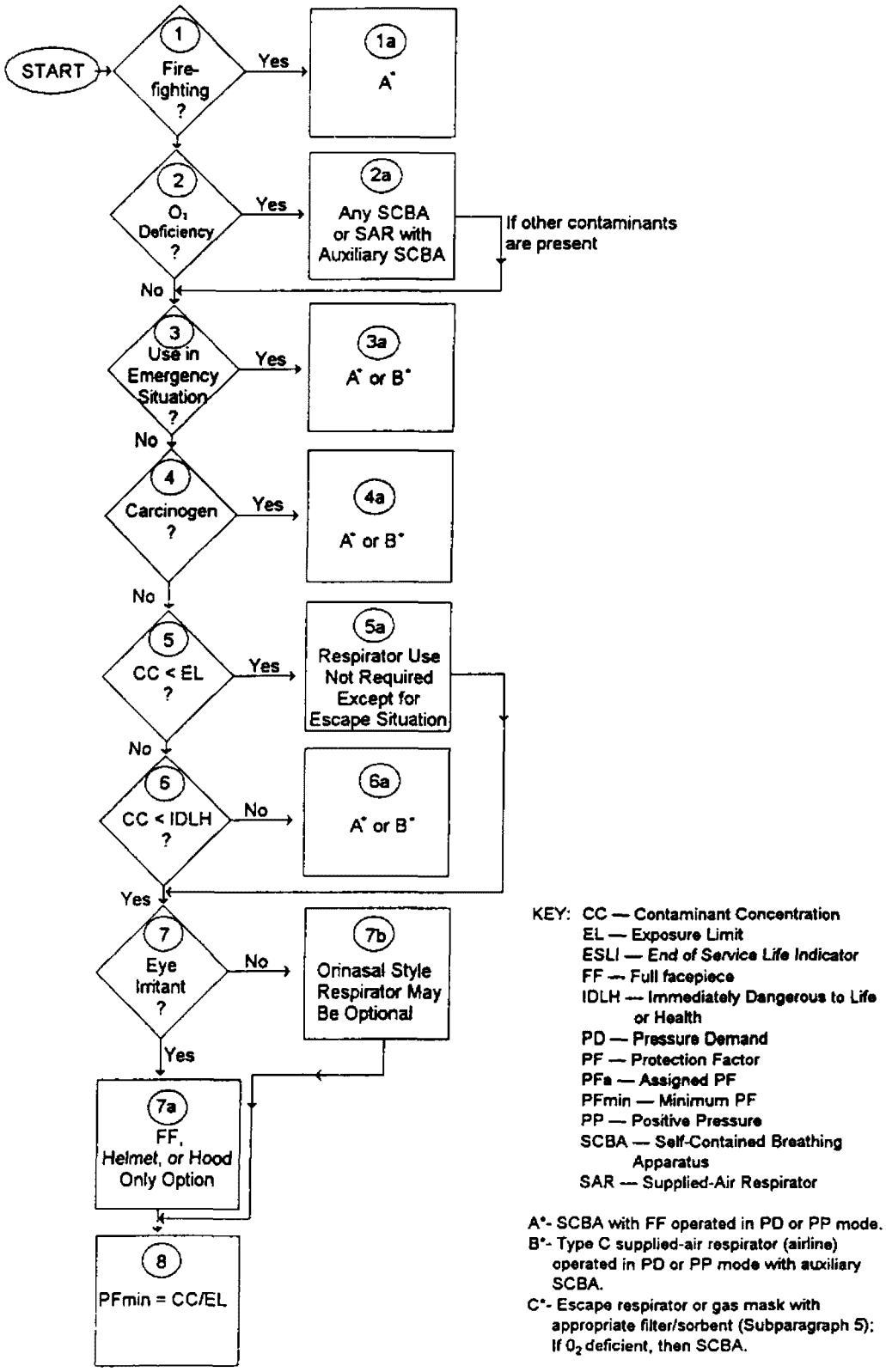



Figure 1. Respirator Decision Logic Sequence
Steps 1–8

*Source:* NIOSH Respirator Decision Logic (U.S. DHHS 1987)

**TP-12**

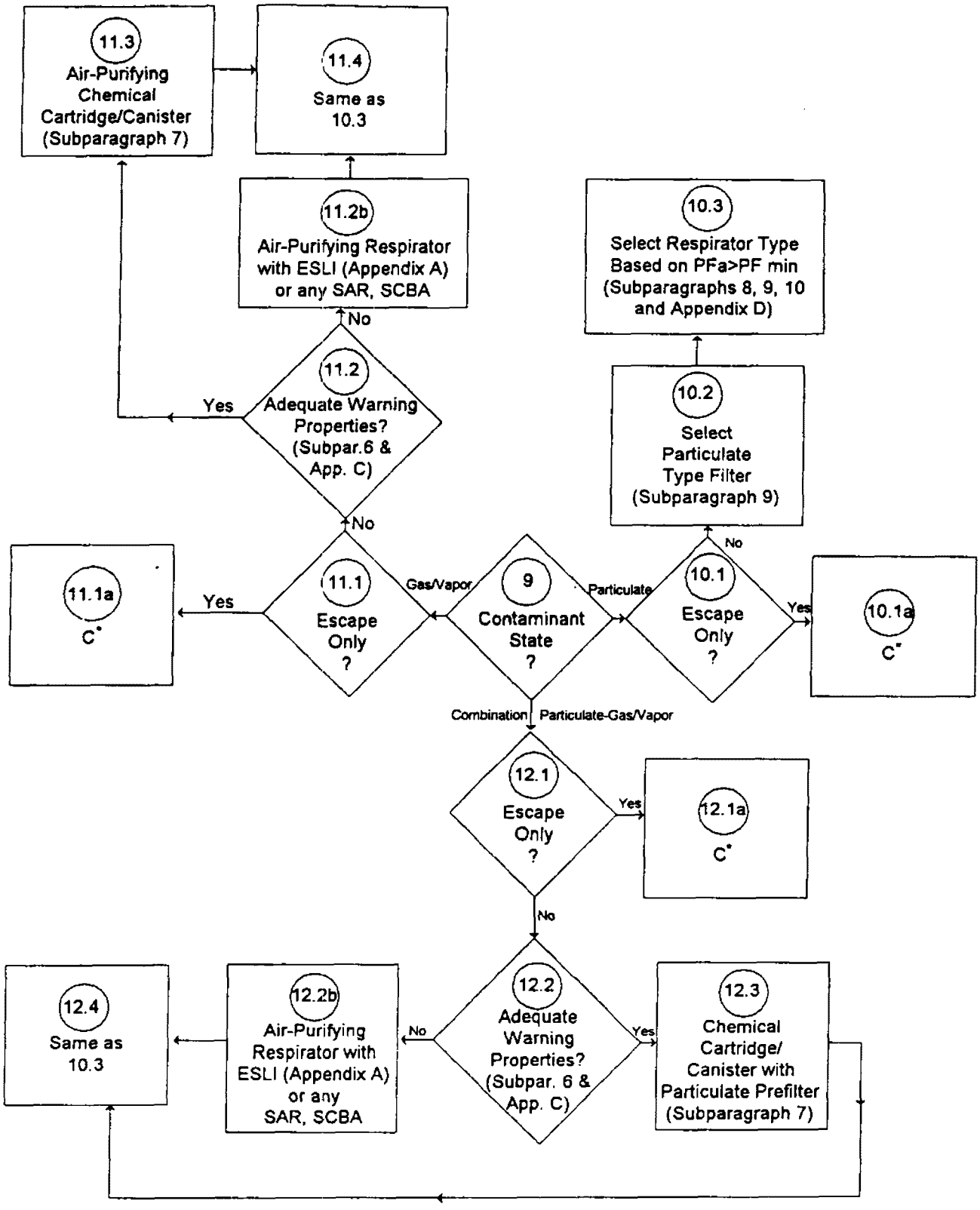



Figure 2. Respirator Decision Logic Sequence
Steps 9–12.4

*Source:* NIOSH Respirator Decision Logic (U.S. DHHS 1987)

**TP-13**

Given conditions at a hazardous waste site, identify respiratory protection.

## Respirator Decision Logic Exercise

- Operation: Bulk sampling of methyl ethyl ketone (MEK)
- Airborne concentration: 500 ppm
- Oxygen concentration: 20.2 percent
- Available respirators:
  1. MSA, full-face, Model 461846 with TC-23C-149 cartridges
  2. Cesco, full-face, Model 95RC35 with TC-23C-126 cartridges
  3. Protech, full-face, Model 1482-G104 with TC-23C-163 cartridges

Given conditions at a hazardous waste site, job tasks, and the results of a hazard and risk analysis, determine the criteria for selecting chemical protective clothing (CPC).

## Guidelines for the Selection of Chemical Protective Clothing

- Decision on appropriate level of protection – EPA protocols
- Chemical protective equipment (CPE) information resources:
  - Internet
  - Manufacturers' information resources
  - Published CPE guidelines

TP-14

# Example: DuPont Protective Apparel for Hydrazines

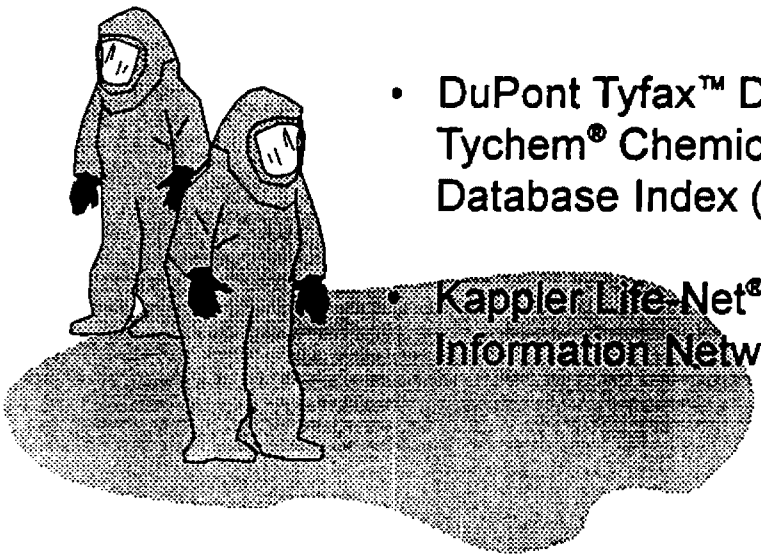
http://www.dupont.com

| Chemical Name | Physical Phase | Normalized Break-through Time (min.) | Actual Break-through Time (min.) | Actual Permeation Rate (ug/cm$^2$ /min.) | Minimum Detection Limit (ppm) | MDPR (ug/cm$^2$ /min.) |
|---|---|---|---|---|---|---|
| **TYVEK® laminated with SARANEX® 23-P 280 - Sub Class: Hydrazines** | | | | | | |
| 1,1-Dimethylhydrazine | L | nm | immed. | 6 | 0.5 | nm |
| Hydrazine | L | nm | >480 | ND | 1.0 | 1.0 |

MDPR = minimum detectable permeation rate
ND = none detected
nm = not measured

**TP-15**

# Manufacturers' Fax Services



- DuPont Tyfax™ Data Service Tychem® Chemical Permeation Database Index (1-800-558-9392)
- Kappler Life-Net® Chemical Protective Information Network (1-205-582-1163)

TP-16

# American Society for Testing and Materials (ASTM) Test Methods

- ASTM F1001 Chemical Test Battery
- ASTM F739-1991 Permeation Testing
- ASTM D751-79 Physical Properties Test

**TP-17**

# Permeation Data — Test Method ASTM F739

DuPont Tyfax™ Example

Tychem® 9400

| | | | Average Breakthrough Time | | Permeation Rate | SDL | MDPR |
|---|---|---|---|---|---|---|---|
| Sub-Class | Chemical Name | Physical Phase | Normalized (min.) | Actual (min.) | (ug/cm$^2$) (min.) | (ppm) | (ug/cm$^2$) (min.) |
| 280 | Hydrazine | L | >480 | >480 | ND | 0.05 | 0.05 |

SDL = system detection limit
MDPR = minimum detectable permeation rate
ND = none detected

TP-18

# SDL and MDPR

- System detection limit (SDL)

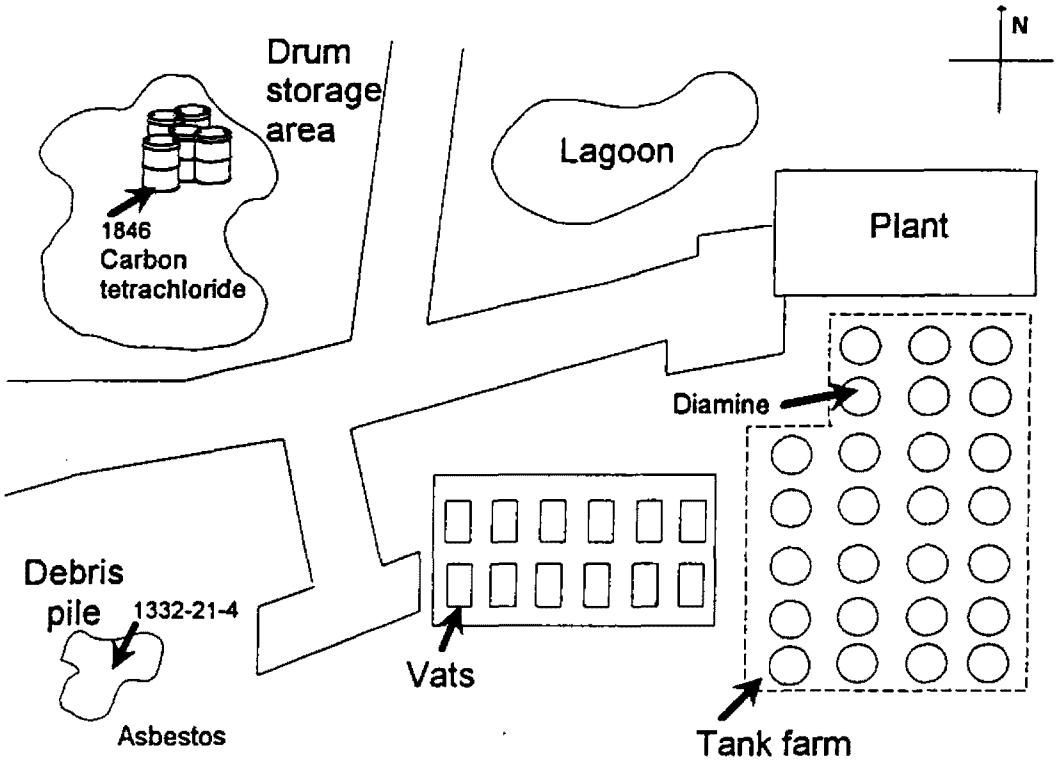
  The sensitivity of the analytical method used for quantitative measurement.

- Minimum detectable permeation rate (MDPR)

  The amount of challenge chemical present that can be calculated into a permeation rate.

TP-19

# The Blue Ridge Chemical Facility




TP-20

## Protective Equipment Worksheet

Operation: Bulk sampling

Material Name: Carbon tetrachloride

Synonyms: Tetrachloromethane, Freon 10, Freon 104

Physical Characteristics

Physical state (circle one): Solid Liquid Gas/vapor

Toxicity Characteristics (circle one)

| | | | | |
|---|---|---|---|---|
| Inhalation: | Yes | No | | |
| Ingestion: | Yes | No | | |
| Absorption: | Yes | No | | |
| Contact: | Yes | No | | |
| Eye irritant: | Yes | No | | |
| Carcinogenic: | Yes | No | | |
| Warning property: | Odor | Taste | Effect | None |

Warning concentrations: _____

IDLH concentrations: _____

Exposure limit: _____

Field Characteristics

Oxygen level: _____

Contaminant concentration: _____

Respiratory Protection

Respirator type
(from NIOSH Decision Logic): _____

Available respirators:

1. Manufacturer: MSA
   Model: 473268 (SCBA)
   NIOSH certification number: TC-13F-139
2. Manufacturer: 3M
   Model: W415 (PAPR)
   NIOSH certification number: TC-21C-456
3. Manufacturer: MSA
   Model: 461853 (APR)
   NIOSH certification number: TC-23C-155

Respirator choice: _____

## Protective Equipment Worksheet (cont.)

Chemical Protective Clothing

Available protective materials (performance information is listed in the Kappler Life-Net® and DuPont Tyfax™ data sheets):

| | Kappler | DuPont |
|---|---|---|
| 1. Suit: | **Responder or Responder Plus** | **Tychem® 9400** |
| Chemical qualities: | | |
| Physical qualities: | | |
| Cost: | | |
| 2. Suit: | —— | **Tychem® 10,000** |
| Chemical qualities: | | |
| Physical qualities: | | |
| Cost: | | |
| 3. Suit: | —— | —— |
| Chemical qualities: | | |
| Physical qualities: | | |
| Cost: | | |

Protective clothing choice: _____

## Protective Equipment Worksheet

Operation: Bulk sampling

Material Name: Hydrazine (anhydrous)

Synonyms: Diamine

Physical Characteristics

Physical state (circle one): Solid Liquid Gas/vapor

Toxicity Characteristics (circle one)

| | | | | |
|---|---|---|---|---|
| Inhalation: | Yes | No | | |
| Ingestion: | Yes | No | | |
| Absorption: | Yes | No | | |
| Contact: | Yes | No | | |
| Eye irritant: | Yes | No | | |
| Carcinogenic: | Yes | No | | |
| Warning property: | Odor | Taste | Effect | None |

Warning concentrations: _____

IDLH concentrations: _____

Exposure limit: _____

Field Characteristics

Oxygen level: _____

Contaminant concentration: _____

Respiratory Protection

Respirator type
(from NIOSH Decision Logic): _____

Available respirators:

1. Manufacturer: MSA
   Model: 473268 (SCBA)
   NIOSH certification number: TC-13F-139
2. Manufacturer: 3M
   Model: W415 (PAPR)
   NIOSH certification number: TC-21C-456
3. Manufacturer: MSA
   Model: 461853 (APR)
   NIOSH certification number: TC-23C-155

Respirator choice: _____

## Protective Equipment Worksheet (cont.)

Chemical Protective Clothing

Available protective materials (performance information is listed in the Kappler Life-Net® and DuPont Tyfax™ data sheets):

| | Kappler | DuPont |
|---|---|---|
| 1. Suit: | **CPF 2** | **Tyvek® with Saranex** |
| Chemical qualities: | | |
| Physical qualities: | | |
| Cost: | | |
| 2. Suit: | **CPF 4** | **Tychem® 9400** |
| Chemical qualities: | | |
| Physical qualities: | | |
| Cost: | | |
| 3. Suit: | **Responder or Responder Plus** | —— |
| Chemical qualities: | | |
| Physical qualities: | | |
| Cost: | | |

Protective clothing choice: _____

## Protective Equipment Worksheet

Operation: Bulk sampling

Material Name: Asbestos

Synonyms: Chrysotile, amosite, temolite

Physical Characteristics

Physical state (circle one): Solid Liquid Gas/vapor

Toxicity Characteristics (circle one)

| | | | | |
|---|---|---|---|---|
| Inhalation: | Yes | No | | |
| Ingestion: | Yes | No | | |
| Absorption: | Yes | No | | |
| Contact: | Yes | No | | |
| Eye irritant: | Yes | No | | |
| Carcinogenic: | Yes | No | | |
| Warning property: | Odor | Taste | Effect | None |

Warning concentrations: _____

IDLH concentrations: _____

Exposure limit: _____

Field Characteristics

Oxygen level: _____

Contaminant concentration: _____

Respiratory Protection

Respirator type
(from NIOSH Decision Logic): _____

Available respirators:

1. Manufacturer: MSA
   Model: 473268 (SCBA)
   NIOSH certification number: TC-13F-139
2. Manufacturer: 3M
   Model: W415 (PAPR)
   NIOSH certification number: TC-21C-456
3. Manufacturer: MSA
   Model: 461853 (APR)
   NIOSH certification number: TC-23C-155

Respirator choice: _____

## Protective Equipment Worksheet (cont.)

Chemical Protective Clothing

Available protective materials (performance information is listed in the Kappler Life-Net® and DuPont Tyfax™ data sheets):

| | Kappler | DuPont |
|---|---|---|
| 1. Suit: | —— | **Tyvek® 1422A** |
| Chemical qualities: | | |
| Physical qualities: | | |
| Cost: | | |
| 2. Suit: | —— | —— |
| Chemical qualities: | | |
| Physical qualities: | | |
| Cost: | | |
| 3. Suit: | —— | —— |
| Chemical qualities: | | |
| Physical qualities: | | |
| Cost: | | |

Protective clothing choice: _____

# Conclusion

- Hazard and Risk Analysis
- Air Monitoring Plans and Strategies
- Air Impact Assessments
- **Personal Protective Equipment Decision-making**

**TP-21**

## Crossword Puzzle

**Across**

14. The physical process by which a chemical breaks through a protective suit is known as _____

21. The time it takes for a contaminant to move through a filter to the inside of an air-purifying respirator is known as _____ time

# APPENDIX

## Chemical Clothing Manufacturers' Permeation Data Sheets

The data sheets in this appendix are included as examples of the information that is available through manufacturers' fax services. These data sheets should not be used for actual CPC decision-making because they may not show the most current data. Both the Kappler Life-Net® Chemical Protective Information Network and the DuPont Tyfax™ data service are updated on an ongoing basis. Students should obtain the most current data before deciding what fabric to use with a specific chemical.

Kappler data sheets have been reprinted with permission from Kappler. DuPont data sheets have been reprinted with permission from DuPont.

# Life-Net®

## Chemical Protective Information Network

**Thank you for contacting Kappler's *Life-Net*® information system. The data you requested will follow this cover page. Please read the following information, and if you have questions contact:**

**1-800-633-2410 or (205) 505-4000, FAX (205) 582-2706**

---

- Chemical permeation data is available per ASTM F739-91. Many of these chemicals are known by more than one name. For this reason, you may wish to obtain the Cross Reference Synonym List that provides additional names by which chemicals may be known.

- Where the testing time is listed as >480 minutes, the test was terminated at that respective time with no measurable breakthrough.

- Sources for all test data are independent laboratories. All tests were performed under laboratory conditions and not under actual use conditions. Tests were performed on material samples, not actual garments.

- There are uses, environments, and chemicals for which these garments are unsuitable. It is the responsibility of the user to review available data and verify that the garment is appropriate for the intended use and meets all specified government and industry standards.

- *Responder Plus*™ fabric has at least the same chemical permeation resistance as the original Responder® fabric. This position is supported by two facts. First, *Responder Plus* utilizes the same proven chemical barriers as *Responder*. Secondly, all actual testing of *Responder Plus* to date shows equivalent permeation resistance results. Therefore, all chemical permeation resistance data available on *Responder* can also be applied to *Responder Plus*. Separate physical property data must be referenced. The data for the chemicals indicated with an asterisk (*) is actual testing on *Responder* fabric.

**Definition of terms**

**SDL = System Detection Limit (or MDL - Minimum Detection Limit)**: These terms describe the sensitivity of the analytical method used for quantitative measurement. This limit is determined prior to each individual permeation test by exposing the detection device to a minimum known quantity of the challenge chemical that produces a measurable signal from the device. SDLs and MDLs are typically expressed in parts per million (ppm) and should not be greater than 1ppm for most tests or materials. Higher limits result in longer breakthrough times. Kappler requests that laboratories test our materials at <1ppm, where that level is possible.

**PR = Permeation Rate**: The rate at which permeation occurs in weight of chemical per exposed unit area of material per unit time. Typically, rates are expressed as micrograms per square centimeter per minute. Rates may also be identified as maximum or steady state, depending on test length and whether equilibrium conditions are reached.

**Normalized Breakthrough Time**: The time at which the permeation rate reaches 0.1ug/cm²/min.

*– Revised November 1996*

# Kappler

## LIMITED USE PERMEATION GUIDE

(REVISED November 1996)

| Chemical | CPF 1 | | | CPF 2 | | | CPF 3 | | | CPF 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Breakthrough Time Normalized (min) | Permeation Rate (ug/cm2/min) | SDL (ppm) | Breakthrough Time Normalized (min) | Permeation Rate (ug/cm2/min) | SDL (ppm) | Breakthrough Time Normalized (min) | Permeation Rate (ug/cm2/min) | SDL (ppm) | Breakthrough Time Normalized (min) | Permeation Rate (ug/cm2/min) | SDL (ppm) |
| Glade Intech 200 | nt | | | >480 | ND | 0.020 | nt | | | nt | | |
| Glutaraldehyde (50%) | >480 | ND | 0.020 | >480 | ND | 0.200 | nt | | | nt | | |
| Glycerin | nt | | | nt | | | nt | | | >480 | ND | 0.020 |
| Hexachlorobutadiene -1,3 | nt | | | nt | | | nt | | | nt | | |
| Hexachloropentadiene | nt | | | nt | | | 470 | 72.12 | NA | nt | | |
| Hexane | <4 | 17 | 0.010 | 10 | 0.28 | 0.010 | >480 | ND | 0.010 | >480 | ND | 0.010 |
| Hydrazine | nt | | | 437 | 0.2 | 0.200 | nt | | | >480 | ND | 0.020 |
| Hydrochloric Acid (37%) | <90 | 1.4 | 0.400 | >480 | ND | 0.400 | >480 | ND | 0.180 | >480 | ND | 0.400 |
| Hydrofluoric Acid (48%) | >480 | ND | 1.000 | >480 | ND | 1.000 | 180 | 0.86 | 0.500 | >480 | ND | 1.000 |
| Hydrogen Cyanide | nt | | | nt | | | nt | | | >480 | ND | 0.025 |
| Hydrogen Fluoride Anhydrous | nt | | | nt | | | 50 | 5.73 | 0.100 | 300 | 1.3 | 1.000 |
| Hydrogen Fluoride Gas | nt | | | 35 | 3.53 | 1.000 | 170 | 6.7 | 1.000 | nt | | |
| Hydrogen Peroxide (50%) | nt | | | nt | | | >480 | <.002 | | nt | | |
| Hydrogen Sulfide | nt | | | nt | | | 5 | 1.8 | 2.800 | nt | | |
| Hypophosphorus Acid (50%) | nt | | | nt | | | >480 | <0.01 | 0.070 | nt | | |
| Isoamyl Alcohol | nt | | | >480 | ND | 0.020 | nt | | | nt | | |
| Isopropylamine | nt | | | nt | | | 15 | 22 | 0.010 | nt | | |
| Isopropyl Alcohol | nt | | | nt | | | >480 | ND | 0.003 | >480 | ND | 0.020 |
| Jet Fuel A (mixture) | nt | | | >480 | ND | 0.010 | nt | | | nt | | |
| JP-4 (mixture) | nt | | | >480 | ND | 0.010 | nt | | | nt | | |
| Malathion (50%) | nt | | | >480 | ND | 0.040 | nt | | | nt | | |
| MDA Mixture | nt | | | >480 | ND | 1.000 | nt | | | nt | | |
| Mercury | nt | | | >480 | ND | 0.005 | nt | | | nt | | |
| Methanol | <5 | 0.59 | 0.020 | >480 | ND | 0.090 | 8 | 0.98 | 0.070 | >480 | ND | 0.020 |
| Methyl Ethyl Ketone | nt | | | 10 | 13 | 0.010 | >480 | ND | 0.010 | >480 | ND | 0.010 |
| Methyl Isocyanate (90%) | nt | | | nt | | | nt | | | >480 | ND | 0.330 |
| Methyl 2-, 1,3 - Propanediol | nt | | | nt | | | nt | | | >480 | ND | 0.020 |
| Methyl Pyrrolidone n- | nt | | | nt | | | nt | | | >480 | ND | 0.020 |
| Methylamine | nt | | | nt | | | 140 | 8.04 | 0.040 | 240 | 0.89 | 0.010 |
| Mono Propylene Glycol | nt | | | nt | | | nt | | | >480 | ND | 0.200 |
| Nicotine | nt | | | 105 | 312 | 0.800 | >720 | ND | 0.010 | nt | | |
| Nitric Acid (70% [CPF III @ 90%] | >480 | ND | 1.000 | >480 | ND | 1.000 | >480 | ND | 0.117 | >480 | ND | 1.000 |
| Nitrobenzene | <5 | 7.2 | 0.010 | 205 | 3 | 0.200 | >480 | ND | 0.010 | >480 | ND | 0.030 |
| Octanoic Acid | nt | | | nt | | | nt | | | >480 | ND | 13.000 |

Kappler

# LIMITED USE PERMEATION GUIDE

(REVISED November 1996)

| Chemical | RESPONDER | | | RESPONDER PLUS | | | REFLECTOR | | |
|---|---|---|---|---|---|---|---|---|---|
| | Breakthrough Time Normalized (min) | Permeation Rate (ug/cm2/min) | SDL (ppm) | Breakthrough Time Normalized (min) | Permeation Rate (ug/cm2/min) | SDL (ppm) | Breakthrough Time Normalized (min) | Permeation Rate (ug/cm2/min) | SDL (ppm) |
| Butadiene 1,3- | >480 | ND | 0.066 | >480 | ND | 0.066 | >480 | ND | 0.010 |
| Butanol N- | >480 | ND | 0.072 | >480* | ND | 0.072 | nt | | |
| Butyl Acrylate | >480 | ND | 0.100 | >480* | ND | 0.100 | nt | | |
| Butyl Ether N- | >480 | ND | 0.025 | >480* | ND | 0.025 | nt | | |
| Butyl Methyl Ether T- | >180 | ND | 0.210 | >180* | ND | 0.210 | nt | | |
| Butylamine N- | >480 | ND | 0.010 | >480* | ND | 0.010 | nt | | |
| Butylene Oxide 1, 2- | >240 | ND | 0.010 | >240* | ND | 0.010 | nt | | |
| Butyraldehyde | >480 | ND | 0.030 | >480* | ND | 0.030 | nt | | |
| Calcium Chloride 42%W/W | >240 | ND | 1.000 | >240* | ND | 1.000 | nt | | |
| Carbon Disulfide | >480 | ND | 1.000 | >480 | ND | 1.000 | >480 | ND | 0.010 |
| Carbon Tetrachloride (Spectral) | >480 | ND | 0.600 | >480* | ND | 0.600 | nt | | |
| Chlorine Dioxide (5%) | >480 | ND | 1.000 | >480* | ND | 1.000 | nt | | |
| Chlorine Gas | >480 | ND | 0.041 | >480 | ND | 0.041 | >480 | ND | 2.500 |
| Chlorine Liquid | >480 | ND | 5.000 | >480* | ND | 5.000 | nt | | |
| Chloro-1,3 Butadiene 2- | >480 | ND | 0.010 | >480* | ND | 0.010 | nt | | |
| Chloroacetic Acid 65 Degrees C | 60 | 63.7 | 0.060 | 60* | 63.7 | 0.060 | nt | | |
| Chloroacetopheonone | >480 | ND | 0.500 | >480* | ND | 0.500 | nt | | |
| Chloroacrylonitrile 2- | >480 | ND | 0.160 | >480* | ND | 0.160 | nt | | |
| Chlorobenzene | >480 | ND | 0.500 | >480* | ND | 0.500 | nt | | |
| Chloroform | >480 | ND | 0.097 | >480* | ND | 0.097 | nt | | |
| Chloropicrin | >480 | ND | 0.100 | >480* | ND | 0.100 | nt | | |
| Chlorosulfonic Acid | >480 | ND | 1.000 | >480* | ND | 1.000 | nt | | |
| Chromic Acid | >480 | ND | 1.000 | >480* | ND | 1.000 | nt | | |
| Cresols | >480 | ND | 0.010 | >480* | ND | 0.010 | nt | | |
| Crotonaldehyde | >480 | ND | 0.100 | >480* | ND | 0.100 | nt | | |

# Kappler

## LIMITED USE PERMEATION GUIDE

(REVISED November 1996)

| Chemical | RESPONDER Breakthrough Time Normalized (min) | RESPONDER Permeation Rate (ug/cm2/min) | RESPONDER SDL (ppm) | RESPONDER PLUS Breakthrough Time Normalized (min) | RESPONDER PLUS Permeation Rate (ug/cm2/min) | RESPONDER PLUS SDL (ppm) | REFLECTOR Breakthrough Time Normalized (min) | REFLECTOR Permeation Rate (ug/cm2/min) | REFLECTOR SDL (ppm) |
|---|---|---|---|---|---|---|---|---|---|
| Ethylene | >480 | ND | 0.020 | >480* | ND | 0.020 | nt | | |
| Ethylene Diamine | >480 | ND | 0.010 | >480* | ND | 0.010 | nt | | |
| Ethylene Dichloride | >480 | ND | 0.053 | >480* | ND | 0.053 | nt | | |
| Ethylene Glycol | >240 | ND | 0.120 | >240* | ND | 0.120 | nt | | |
| Ethylene Oxide Gas | >480 | ND | 0.210 | >480 | ND | 0.210 | >480 | ND | 1.400 |
| Ethylene Oxide Liquid | >180 | ND | 0.083 | >180* | ND | 0.083 | nt | | |
| Ethyleneimine | <357 | 0.032 | 0.010 | <357* | 0.032 | 0.010 | nt | | |
| Ferric Chloride (saturated) | >480 | ND | 1.000 | >480* | ND | 1.000 | nt | | |
| Ferrous Chloride (saturated) | >480 | ND | 1.000 | >480* | ND | 1.000 | nt | | |
| Fluorine | >480 | ND | 0.014 | >480* | ND | 0.014 | nt | | |
| Fluosilicic Acid | >480 | ND | 1.000 | >480* | ND | 1.000 | nt | | |
| Formaldehyde | >480 | ND | 0.050 | >480* | ND | 0.050 | nt | | |
| Formic Acid | >480 | ND | 0.100 | >480* | ND | 0.100 | nt | | |
| Freon 113 | >480 | ND | 0.059 | >480* | ND | 0.059 | nt | | |
| Freon TF (N/A) | >240 | ND | 10.000 | >240* | ND | 10.000 | nt | | |
| Gamma-Butyrolactone | >480 | ND | 0.020 | >480* | ND | 0.020 | nt | | |
| Gasoline | >480 | ND | 0.560 | >480* | ND | 0.560 | nt | | |
| Hexachlorobutadiene -1,3 | >480 | ND | 0.500 | >480* | ND | 0.500 | nt | | |
| Hexachlorocyclopentadiene | >480 | ND | 0.050 | >480* | ND | 0.050 | nt | | |
| Hexane | >480 | ND | 0.060 | >480 | ND | 0.060 | >480 | ND | 0.010 |
| Hexene 1- | >480 | ND | 0.010 | >480* | ND | 0.010 | nt | | |
| Hydrazine | >480 | ND | 0.020 | >480* | ND | 0.020 | nt | | |
| Hydrazine Hydrate | >240 | ND | 0.030 | >240* | ND | 0.030 | nt | | |
| Hydrobromic Acid (48%) | >480 | ND | 0.190 | >480* | ND | 0.190 | nt | | |
| Hydrochloric Acid (37%) | >240 | ND | 0.200 | >240* | ND | 0.200 | nt | | |

# *System CPF*®– The First Complete Matrix Of Protective Garments

Only Kappler offers a complete family of fabrics and garments that allows easy selection of the right protection. And with superior physical properties over traditional materials, *System CPF* fabrics perform better in strength and durability tests – eliminating many of the rip-out problems common with other materials.

**CPF 1 Garments** provide increased physical strength and splash resistance over competing fabrics by laminating a multi-layer barrier film to a durable polypropylene substrate. *CPF 1* garments should be used in situations where workers need protection from dry particulates and light splash. Available with Serged or Bound seams, color is blue.

*Applications:* Acid Handling, Tank Cleaning, Mixing Agrichemicals, Oil Refining

**CPF 2 Garments** offer greater tear resistance and chemical hold-out by laminating a layer of co-extruded barrier film to a tough 1.5 oz. polypropylene substrate. They can be used against a wide variety of chemicals and where rip-out is a concern. Color is gray. Seams available: Bound or Strapped.

*Applications:* Chemical Handling, PCB Clean-up, Hazardous Materials/Waste Clean-up, Fire Departments, Industrial Hazmat Teams, Utilities

**CPF 3 Garments** are constructed from a multi-layer barrier film laminated to a durable 2.0 oz. polypropylene substrate. They offer greater physical strength and chemical hold-out when compared to traditional film products. *CPF 3* garments should be used in rigorous activities and where there is potential for chemical splash. Tan color, Bound or Strapped seams.

*Applications:* Chemical Handling, Petro Chemical Market, Hazardous Materials/Waste Clean-up, Fire Departments, Industrial Hazmat Teams, Utilities

**CPF 4 Garments** are constructed of a multi-film composite laminated to a high strength 2.3 oz. polypropylene substrate. They offer chemical protection normally found in suits costing much more. In fact, *CPF 4* provides one of the broadest ranges of chemical protection available for Level B suits, eliminating the need to inventory many kinds of protective garments. Color is green, available in Strapped seam.

*Applications:* Chemical Handling, Petro Chemical Market, Hazardous Materials/Waste Clean-up, Fire Departments, Hazmat Teams, Utilities

**Kappler High-End Encapsulating Suits Offer:**

- Large view window (polished PVC)
- Detachable Butyl gloves (Level A)
- Sewn and heat sealed seams
- Internal waist belt
- Roomy sleeves and tapered shape for easy mobility
- Sock boots with splash guards
- Easy to reach zipper with double [illegible] lapping strip, flap hook and [illegible]
- Exhaust [illegible] with covers [illegible] ports [illegible] Level B

Kappler

In the U.S.A. [illegible]
In Canada [illegible]

# Other Available Styles For *System CPF®* Garments

**Apron**
Open Back. Snap at Neck. Elastic Wrists. Wraparound Waist Tie

CPF 1
Bound – 1B347
25 cs. 13 lb 5.9 kg
CPF 2
Bound – 2B347
25 cs.16 lb 7.3 kg
CPF 3
Bound – 3B347
25 cs. 17 lb / 7.7 kg
CPF 4
Strapped – 4T347
6 cs. 9 lb 4.1 kg

**Coverall**
Zipper Front Collar

CPF 1
Serged – 1S412
12 cs. 12 lb 5.4 kg
Bound – 1B412
12 cs. 13 lb 5.9 kg
CPF 2
Bound – 2B412
12 cs. 15 lb 6.8 kg
Strapped – 2T412
6 cs. 8 lb 3.6 kg
CPF 3
Bound – 3B412
12 cs. 15 lb / 6.8 kg
Strapped – 3T412
6 cs. 11 lb / 5 kg
CPF 4
Strapped – 4T412
6 cs 15 lb 6.8 kg

**Coverall**
Zipper Front. Attached Hood. Boots and Elastic Wrists

CPF 1
Serged – 1S414
12 cs. 14 lb 6.4 kg
Bound – 1B414
12 cs. 16 lb / 7.3 kg
CPF 2
Bound – 2B414
12 cs. 18 lb / 8.2 kg
Strapped – 2T414
6 cs. 9 lb / 4.1 kg
CPF 3
Bound – 3B414
12 cs. 18 lb / 8.2 kg
Strapped – 3T414
6 cs. 11 lb / 5 kg

**Coverall**
Zipper Front. Collar Elastic Wrists and Ankles

CPF 1
Serged – 1S417
12 cs. 11 lb 5 kg
Bound – 1B417
12 cs. 11 lb 5 kg
CPF 2
Bound – 2B417
12 cs. 15 lb 6.8 kg
Strapped – 2T417
6 cs. 8 lb / 3.6 kg
CPF 3
Bound – 3B417
12 cs. 16 lb 7.3 kg
Strapped – 3T417
6 cs. 10 lb 4.5 kg
CPF 4
Strapped – 4T417
6 cs. 14 lb 6.4 kg
Responder
Double Storm Flaps with Velcro Closure over Zipper
Strapped – 41250
1 cs. 4 lb 2 kg

**Coverall**
Zipper Front. Attached Hood

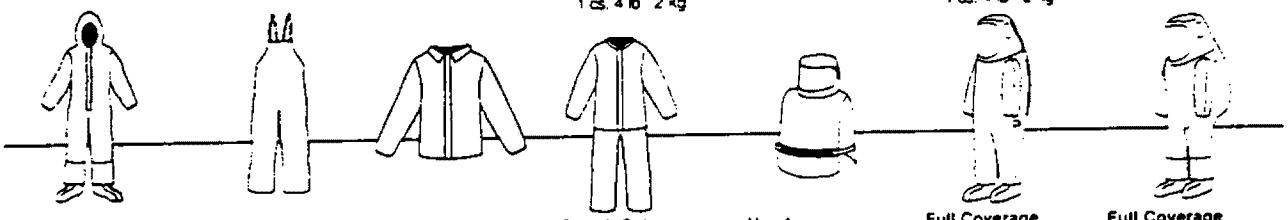
CPF 1
Serged – 1S427
12 cs. 12 lb 5.4 kg
Bound – 1B427
12 cs 12 lb 5.4 kg
CPF 2
Bound – 2B427
12 cs. 15 lb 6.8 kg
Strapped – 2T427
6 cs. 9 lb 4.1 kg
CPF 3
Bound – 3B427
12 cs. 19 lb 8.6 kg
Strapped – 3T427
6 cs. 10 lb 4.5 kg

**Coverall**
Zipper Front. Attached Hood. Elastic Wrists and Ankles

CPF 1
Serged – 1S428
12 cs 12 lb 5.4 kg
Bound – 1B428
12 cs. 12 lb 5.4 kg
CPF 2
Bound – 2B428
12 cs. 16 lb 7.3 kg
Strapped – 2T428
6 cs. 9 lb 4.1 kg
CPF 3
Bound – 3B428
12 cs 15 lb 6.8 kg
Strapped – 3T428
6 cs. 10 lb 4.5 kg
CPF 4
Strapped – 4T428
6 cs 17 lb 7.7 kg
Responder
Double Storm Flaps with Velcro Closure over Zipper
Strapped – 41255
1 cs. 4 lb 2 kg

**Coverall**
Zipper Front. Attached Hood and Sock Boots. Elastic Wrists

CPF 2
Bound – 2B434
12 cs. 18 lb 8.2 kg
Strapped – 2T434
6 cs. 11 lb 5 kg
CPF 3
Bound – 3B434
12 cs. 18 lb 8.2 kg
Strapped – 3T434
6 cs. 12 lb 5.4 kg
CPF 4
Strapped – 4T434
6 cs. 20 lb 9 kg



**Coverall**
Zipper Front. Attached Hood. Sock Boot with Boot Flap. Elastic Wrists

CPF 2
Bound – 2B436
12 cs.19 lb / 8.6 kg
Strapped – 2T436
6 cs. 10 lb / 4.5 kg
CPF 3
Bound – 3B436
12 cs. 20 lb / 9 kg
Strapped – 3T436
6 cs. 12 lb 5.4 kg
CPF 4
Strapped – 4T436
6 cs 19 lb 8.6 kg
Responder
Double Storm Flap with Velcro Closure Over Zipper
Strapped – 41255-8A
1 cs 5 lb 2.3 kg

**Bib Overall**
Adjustable Webbing Straps with Snap Lock Closure

CPF 3
Strapped – 3T459
6 cs.8 lb 3.6 kg
CPF 4
Strapped – 4T459
6 cs. 9 lb 4.1 kg
Responder
Strapped – 41620
1 cs. 4 lb 2 kg

**Jacket**
Zipper Front with Double Storm Flap (Velcro Closure). Elastic Wrists

CPF 3
Strapped – 3T670
6 cs. 7 lb / 3.2 kg
CPF 4
Strapped – 4T670
6 cs. 10 lb / 4.5 kg
Responder Jacket
Triple Storm Flap with Velcro Closure. Hemmed Wrists. Short Collar
Strapped – 41615
1 cs. 3 lb 1.4 kg

**Splash Suit**
Two-piece splash suit with 41620 overall and 41615 jacket

Responder
Strapped – 41610
1 cs. 6 lb / 2.7 kg

**Hood**
Waist Length Dickie Velcro Closures 20 mil PVC Face Shield One Size

CPF 3
Strapped – 3T651
6 cs. 8 lb 3.6 kg
CPF 4
Strapped – 4T651
6 cs. 10 lb 4.5 kg
Responder Hood
Waist length dickie. Velcro closures. 40 mil PVC face shield
Strapped – 41750
1 cs. 4 lb 2 kg

**Full Coverage Level B Suit**
20 mil PVC Face Shield. Exhaust Port. Rear Zipper with Storm Flap. Attached Boots

CPF 1
Bound – 1B545
6 cs. 11 lb 5 kg
CPF 2
Bound – 2B545
6 cs. 12 lb 5.4 kg
Strapped – 2T545
6 cs. 15 lb 6.8 kg
CPF 3
Strapped – 3T545
6 cs. 13 lb 5.9 kg
CPF 4
Strapped – 4T545
5 cs. 22 lb 10 kg

**Full Coverage Level B Suit**
20 mil PVC Face Shield. Expanded Back. Exhaust Port. Rear Zipper with Storm Flap. Attached Sock Boots with Boot Flap

CPF 2
Bound – 2B586
6 cs. 15 lb 6.8 kg
Strapped – 2T586
6 cs. 19 lb 8.6 kg
CPF 3
Strapped – 3T586
6 cs. 20 lb 9 kg
CPF 4
Strapped – 4T586
6 cs. 31 lb 14 kg

## Other *Responder* Products *(not illustrated)*

**Totally Encapsulating Training Suit**
Front Entry – 41455
1 cs 7 lb 3.2 kg
Rear Entry – 41456
1 cs 7 lb 3.2 kg

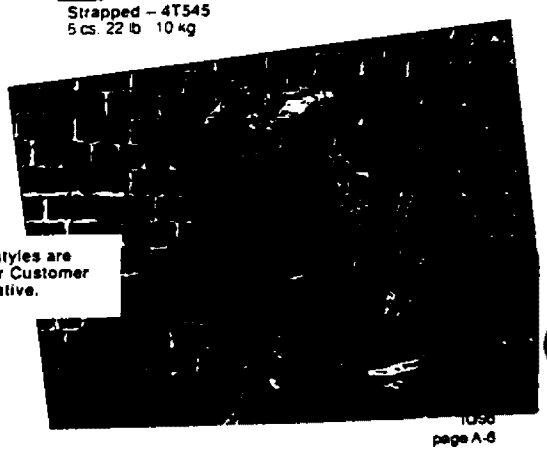
**Hood**
Flat back. sleeve guards shorter length larger view window
Seam – 41755
1 cs. 5 lb 2.3 kg

**Hood**
Expanded Back
Seam – 41751
1 cs. 4 lb 2 kg

**Bib Apron**
Seam – 41900
1 cs. 2 lb 9 kg

**Sleeve Apron**
Seam – 41950
1 cs. 3 lb 1.4 kg

*Responder Plus™* styles are available from your Customer Service Representative.



In the USA: 1-800-633-2410
In Canada: 1-800-387-9326

# Kappler System *CPF* Technical Data

## ASTM F1001 Chemical Test Battery - *SYSTEM CPF*

| | Average Breakthrough Time in Minutes[1,2] | | | | | | |
|---|---|---|---|---|---|---|---|
| **Chemical** | *CPF 1* | *CPF 2* | *CPF 3* | *CPF 4* | *Responder* | *Responder Plus™* | *Reflector™* |
| Acetone | <4 | 12 | >480 | >480 | >480 | >480 | >480 |
| Acetonitrile | <4 | 42 | – | >480 | >480 | >480 | >480 |
| Carbon Disulfide | <4 | <4 | 16 | >480 | >480 | >480 | >480 |
| Dichloromethane | <4 | <4 | – | 114 | >480 | >480 | >480 |
| Diethylamine | <4 | 14 | >480 | >480 | >480 | >480 | >480 |
| Dimethylformamide | 25 | 95 | >480 | >480 | >480 | >480 | >480 |
| Ethyl Acetate | <4 | 28 | >480 | >480 | >480 | >480 | >480 |
| n-Hexane | <4 | 10 | >480 | >480 | >480 | >480 | >480 |
| Methanol | 5 | >480 | 8 | >480 | >480 | >480 | >480 |
| Nitrobenzene | 5 | 205 | >480 | >480 | >480 | >480 | >480 |
| Sodium Hydroxide | >480 | >480 | >480 | >480 | >480 | >480 | >480 |
| Sulfuric Acid | >480 | >480 | >480 | >480 | >480 | >480 | >480 |
| Tetrachloroethylene | <4 | 10 | >480 | >480 | >480 | >480 | >480 |
| Tetrahydrofuran | <4 | <4 | >480 | >480 | >480 | >480 | >480 |
| Toluene | 8 | 4 | >480 | >480 | >480 | >480 | >480 |
| **Gases** | *CPF 1* | *CPF 2* | *CPF 3* | *CPF 4* | *Responder* | *Responder Plus* | *Reflector* |
| Ammonia | NT | NT | 12 | >480 | >480 | >480 | >480 |
| 1,3 Butadiene | NT | NT | >480 | NT | >480 | >480 | >480 |
| Chlorine | NT | >480 | >480 | NT | >480 | >480 | >480 |
| Ethylene Oxide | NT | NT | NT | >480 | >480 | >480 | >480 |
| Hydrogen Chloride | NT | NT | NT | NT | >480 | >480 | >480 |
| Methyl Chloride | NT | NT | NT | NT | >480 | >480 | >480 |

## Physical Properties (measured per ASTM D751-79) – *SYSTEM CPF*

| Test Method | | *CPF 1* | *CPF 2* | *CPF 3* | *CPF 4* | *Responder* | *Responder Plus* | *Reflector* |
|---|---|---|---|---|---|---|---|---|
| Mullen Burst (psi / kPa) | | 100 / 689 | 100 / 689 | 120 / 827 | 225 / 1551 | 174 / 1200 | 274 / 1889 | 834 / 5750 |
| Breaking Strength (Grab Tensile lb / N) | MD: | 62 / 275 | 65 / 289 | 72 / 320 | 124 / 552 | 92 / 409 | 177 / 787 | 502 / 2233 |
| | XD: | 45 / 200 | 43 / 191 | 58 / 258 | 135 / 600 | 93 / 414 | 155 / 689 | 439 / 1952 |
| Trapezoidal Tear (lb / N) | MD | 23 / 102 | 29 / 129 | 36 / 160 | 28 / 124 | 19 / 84 | 40 / 178 | 39 / 174 |
| | XD: | 10 / 44 | 19 / 84 | 24 / 107 | 27 / 120 | 19 / 84 | 53 / 236 | 45 / 200 |

MD: Machine Direction XD: Cross Direction

Sources for all test data are independent laboratories. All Tests were performed under laboratory conditions and not under actual use conditions. Tests were performed on material samples, not actual garments.

[1] Average Breakthrough Time (minutes) - Average time between contact of chemical on outside of material surface and detection of chemical on inside surface.

[2] Breakthrough times normalized to a permeation rate of 0.1 µg/cm2/min in accordance with ASTM F739-1991 revision.

**WARNING:** There are uses, environments and chemicals for which these garments are unsuitable. It is the responsibility of the user to review available data and verify that the garment is appropriate for the intended use and meets all specified government and industry standards.

**CAUTION:** Do not use for fire protection. Avoid open flame or intense heat.

CPF® 3

CPF® 1

In the USA: 1-800-633-2410
In Canada: 1-800-387-9326

# Document Menu

| | | | |
|---|---|---|---|
| 010 | Chemical Index: | A thru C | (alphabetical by initial letter of chemical) |
| 020 | | D thru H | (alphabetical by initial letter of chemical) |
| 030 | Chemical Index: | I thru P | (alphabetical by initial letter of chemical) |
| 040 | Chemical Index: | Q thru Z | (alphabetical by initial letter of chemical) |
| 050 | Listing of available documents (Document Menu) | | |

## TYCHEM® CHEMICAL PERMEATION DATA BY CLASS (ASTM F-1186)

| | | | |
|---|---|---|---|
| 100 | Acids, Carboxylic | 330 | Elements |
| 110 | Acid Halides, Carboxylic | 340 | Inorganic Salts (Solutions) |
| 120 | Aldehydes | 350 | Inorganic Gases and Vapors |
| 130 | Amides | 360 | Inorganic Acid Halides |
| 140 | Amines | 365 | Inorganic Acid Oxides |
| 160 | Anhydrides | 370 | Inorganic Acids |
| 210 | Isocyanates | 380 | Inorganic Bases |
| 220 | Esters Carboxylic | 390 | Ketones |
| 230 | Esters Non-Carboxylic | 430 | Nitriles |
| 240 | Ethers | 440 | Nitro Compounds |
| 260 | Halogen Compounds | 460 | Organo Phosphorous Compounds |
| 270 | Heterocyclic Compounds | 470 | Organo-Metallic Compounds |
| 280 | Hydrazines | 480 | Organo-Silicon Compounds |
| 290 | Hydrocarbons | 500 | Sulfur Compounds |
| 300 | Peroxides | 590 | Miscellaneous |
| 310 | Hydroxylic Compounds | | |

## DU PONT PROTECTIVE APPAREL FABRIC DATA

| | | | |
|---|---|---|---|
| 605 | Permeation Data for ASTM F-1001 List of Chemicals | | |
| | | 630 | Barricade® Physical Properties |
| 610 | Tyvek® Physical Properties | 631 | Barricade® Permeation Data |
| 611 | Tyvek® MSDS | 632 | Barricade® MSDS |
| 615 | Tyvek® QC Physical Properties | 635 | Tychem® 9400 Physical Properties |
| 616 | Tyvek® QC Permeation Data | 636 | Tychem® 9400 Permeation Data |
| 617 | Tyvek® QC MSDS | 637 | Tychem® 9400 MSDS |
| 620 | Tyvek®/Saranex* 23-P Phys. Properties | 640 | Tychem® 10,000 Physical Properties |
| 621 | Tyvek®/Saranex* 23-P Perm. Data | 641 | Tychem® 10,000 Permeation Data |
| | | 642 | Tychem® 10,000 MSDS |
| 625 | Tychem® 7500 Physical Properties | | |
| 626 | Tychem® 7500 Permeation Data | 645 | ComforMax™ |
| 627 | Tychem® 7500 MSDS | 650 | Tyvek® BarriStat® |

## TYVEK® END USE APPLICATIONS INFORMATION

| | | | |
|---|---|---|---|
| 705 | Agriculture | 735 | Food Processing |
| 710 | Asbestos Abatement | 740 | Lead Abatement |
| 715 | Cleanroom | 745 | Nuclear Environments |
| 720 | Dry Chemical Handling | 750 | Paint Spray |
| 725 | Dust and Dirt | 755 | Household Hazardous Waste |
| 730 | Fiberglass | 760 | Emergency Medical Services (EMS) |

## ADDITIONAL DOCUMENTS

| | |
|---|---|
| 805 | Description of ASTM F-739 Permeation Test Method |
| 806 | Description of ASTM F-1186 Chemical Classification System |
| 810 | Chemical Permeation Inquiry Form |
| 815 | *TyLine* Newsletter - latest edition |
| 820 | DuPont Biowear™ Information |
| 825 | Literature Request Form |

*Document 050* *Revised Feb. 1996. Supersedes Oct. 1994.* *© DuPont Company*

# DUPONT TYFAX DATA SERVICE
# TYCHEM® CHEMICAL PERMEATION DATABASE GUIDELINES

## IMPORTANT INFORMATION ABOUT THE TYCHEM PERMEATION DATABASE

This permeation database is provided as a service to users of DuPont TYCHEM protective apparel fabrics. It is the user's responsibility to determine the level of toxicity in a particular situation and to select the proper personal protective equipment needed. This database is intended for professionals with the technical skills necessary for evaluation under their own specific end-use conditions, at their own discretion and risk. The American Industrial Hygiene Association (AIHA) and OSHA publish procedures and standards for the evaluation of personal protective equipment, and this data is intended to be used as part of those evaluation procedures.

The information in the database reflects laboratory performance of TYCHEM *fabrics*, not complete garments, under the controlled conditions of ASTM F739 "Test Method for Resistance of Protective Clothing Materials to Permeation by Liquids and Gases" as reported by independent, AIHA accredited laboratories. *NOTE: Numbers reported are averages of samples tested by the ASTM F739 test method. Sample results do vary and therefore averages for these results are reported.* All permeation tests were conducted with pure chemicals at standard temperature and pressure, unless otherwise specified. Caution should be exercised when evaluating personal protective equipment in situations with mixtures of chemicals or at temperature and pressure conditions other than those specified in ASTM F739.

Anyone intending to use this information should first verify that the *garment* is suitable for the intended use. Seams and closures may have higher permeation rates than the fabric. The garment manufacturer should be contacted for specific data. Garments made with DuPont TYCHEM fabrics should also have slip resistant or antislip materials on the outer surface of boots, shoe-covers or other garment surfaces where slipping could occur.

TYCHEM fabrics covered in this database include TYVEK® QC, TYVEK laminated with Saranex® 23-P, TYCHEM® 7500, TYCHEM® 9400, BARRICADE® and TYCHEM® 10,000.

TYVEK, TYCHEM, and BARRICADE are registered trademarks of DuPont.
TYFAX is a trademark of DuPont.
Saranex 23-P is a registered trademark of The Dow Chemical Company.

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**WARNING:** If the fabric becomes torn, abraded or punctured, the end user should discontinue use to avoid potential exposure to the chemical. TYCHEM fabrics should not be used around heat, sparks, or potentially explosive environments. If the fabric becomes torn, abraded or punctured the end user should discontinue use to avoid potential exposure to the chemical.

Since conditions of use are outside our control, DuPont makes no warranties, express, or implied, including, without limitation no warranties of merchantability or fitness for a particular use, and assumes no liability in connection with any use of this information. This information is not intended as a license to operate under or a recommendation to infringe any patent or technical information of DuPont or others covering any material or its use.

## DEFINITIONS OF TERMS

**ACTUAL BREAKTHROUGH TIME:** the average time elapsed between initial contact of the chemical with the outside surface of the fabric and the detection of permeation.

A breakthrough time of >480 minutes means that no permeation was detected during the normal, 8-hour test duration. When breakthrough was detected at the time of first measurement, DuPont chooses to report the breakthrough time as immediate.

Results of permeation tests are variable. The results reported here are averages from at least three separate samples. Users should not be misled in assuming these breakthrough times and permeation rates are exact. This variability should be taken into account in material selection.

A breakthrough time of >480 and a permeation rate of "ND" does not mean no breakthrough. It means that permeation was not detected. Permeation may have occurred, but at a rate of less than the minimum detectable permeation rate (MDPR). MDPR varies from chemical to chemical. When choosing a chemical barrier fabric, the MDPR and expected exposure times a re used to determine if the level of protection is sufficient for the toxicity of the chemical used.

**NORMALIZED BREAKTHROUGH TIME:** the time at which the permeation rate reaches 0.1 $\mu g/cm^2/min$. Normalized breakthrough times are useful for comparing the barrier performance of fabrics. A normalized breakthrough time of >480 minutes means that average permeation rate never reached 0.1 $\mu g/cm^2/min$.

**PERMEATION:** the process by which a chemical moves through a protective clothing material. Permeation starts with the challenge chemical dissolving into the barrier material, followed by spreading throughout the barrier, and finally diffusion from the unexposed surface.

**PERMEATION RATE:** the rate at which the challenge chemical permeates the fabric. In these tables, the column permeation rate reflects the steady state rate when chemical contact is continuous and all forces affecting permeation have reached equilibrium.

**PHYSICAL PHASE:** the phase of the challenge chemical during the test being reported: (solid-S, liquid-L, gas-G)

**SYSTEM DETECTION LIMIT (SDL):** a measurement of the sensitivity of an analytical system. SDLs are measured in parts per million. SDLs are useful to the laboratory during the analysis of the data and preparation of the test report.

**MINIMUM DETECTABLE PERMEATION RATE (MDPR):** the minimum permeation rate that can be detected during a permeation test. MDPR is a function of the sensitivity of the analytical measurement technique, the volume into which the permeant is collected and sampling time. Minimum detectable permeation rates as low as 0.001 $\mu g/cm^2/min$. are possible on many chemicals.


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## The DuPont Family of Fabrics for Limited-Use Protective Apparel

This line of chemical protective fabrics reflects the ongoing commitment of DuPont to continually improve and broaden our product offering to meet industry needs for quality, high-performance limited-use protective garments.

### Tyvek®

Tyvek® is designed to help keep iritating, potentially harmful dry particulates away from workers' clothes and skin. This fabric is made of sub-micron denier high-density polyethylene filaments that are spun and bonded together by heat and pressure. Tyvek® is ideal in environments where workers are exposed to dry agricultural pesticides, asbestos, dry chemicals, dust and dirt, fiberglass, radioactive dust, and lead particulates.

### Tyvek® QC

Tyvek® QC offers splash protection against many inorganic acids, bases and other liquid chemicals such as pesticides. This fabric is made from Tyvek® that has been "quality coated" with 1.25 mils polyethylene. Tyvek® QC is available in yellow, white and gray.

### Tyvek® laminated with Saranex 23-P

Tyvek® laminated with Saranex® 23-P offers effective protection against a broader range of chemicals than Tyvek® QC and is the only Saranex® 23-P laminated fabric for which DuPont provides permeation data and technical support. This fabric is lightweight and offers economical protection. It is available in white and gray.

### Tychem® 7500

This fabric provides a higher level of chemical splash protection than Tyvek® laminated with Saranex® 23-P. Tychem® 7500 also features higher tensile and burst strengths. Tychem® 7500 is available in light blue and meets all fabric requirements of NFPA 1993.

### Barricade®

Barricade®, a multilayer laminate, provides excellent protection against liquid chemicals and is used in Haz-Mat, industrial and other chemical applications. Barricade® is strong, durable and offers the low cost, convenience and safety of a limited-use fabric. Barricade® is available in yellow and meets all fabric requirements of NFPA 1993.

### Tychem® 9400

This state-of-the-art fabric provides excellent chemical protection against a broad range of chemicals. It is more durable than Barricade® and features greater puncture- and tear-resistance with the convenience and safety of a limited-use fabric. Tychem® 9400 is available in yellow and meets all fabric requirements of NFPA 1993.

### Tychem® 10,000

This newest member of the DuPont Tychem® family of fabrics provides our highest level of durability and chemical protection. Available only in DuPont licensed Tychem® ChemWear® garments, Tychem® 10,000 consistently rates excellent on permeation performance against a wide variety of chemicals and is durable enough to handle emergency response and remediation work. Tychem® 10,000 is available in high-visibility lime yellow in level A or level B garments and in NFPA 1991 certified ensembles.

For specific fabric information, such as physical properties or Material Safety Data Sheets, refer to the Tyfax™ Document Menu (Document 050) or call 1-800-448-9835.

Tychem® Fabric Descriptions Revised Feb. 1996. © 1996 DuPont Company

PERMEATION DATA (test method ASTM F739)

| Sub-Class | Chemical Name | Physical Phase | TYCHEM® 9400 Average Breakthrough Time Normalized (min.) | TYCHEM® 9400 Average Breakthrough Time Actual (min.) | TYCHEM® 9400 Avg. Perm. Rate (µg/cm2/min.) | TYCHEM® 9400 SDL (ppm) | TYCHEM® 9400 MDPR (µg/cm2/min.) | TYCHEM® 10,000 Average Breakthrough Time Normalized (min.) | TYCHEM® 10,000 Average Breakthrough Time Actual (min.) | TYCHEM® 10,000 Avg. Perm. Rate (µg/cm2/min.) | TYCHEM® 10,000 SDL (ppm) | TYCHEM® 10,000 MDPR (µg/cm2/min.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 261 | Carbon tetrachloride | L | >480 | >480 | ND | 0.4 | 0.015 | >480 | imm. | 0.07 | 0.06 | 0.001 |
| 261 | Chlordane | L | nt | nt | nt | nt | nt | >480 | >480 | ND | 0.5 | 0.1 |
| 261 | Chloroform | L | >480 | >480 | ND | 0.1 | 0.004 | >480 | 323 | 0.003 | 0.02 | 0.001 |
| 261 | 1,2-Dichloroethane | L | >480 | >480 | ND | 0.066 | 0.002 | >480 | 124 | 0.026 | 0.01 | 0.001 |
| 261 | 1,3-Dichloroacetone (40° C) | L | nt | nt | nt | nt | nt | >480 | >480 | <0.001 | 0.01 | 0.001 |
| 261 | Dichloromethane | L | 391 | 217 | 0.09 | 0.01 | 0.001 | >480 | >480 | ND | 0.01 | 0.001 |
| 261 | 2,3-Dichloropropene | L | >480 | >480 | ND | 0.3 | 0.008 | nt | nt | nt | nt | nt |
| 261 | 1,1-Dichlorotetrafluoroethane | L | nt | nt | nt | nt | nt | nt | nt | nt | nt | nt |
| 261 | Ethylene dibromide | L | >480 | >480 | ND | 0.01 | 0.1 | >480 | imm. | 0.02 | 0.03 | 0.001 |
| 261 | FREON® 113 | G | nm | >480 | ND | 0.06 | nm | nt | nt | nt | nt | nt |
| 261 | Lindane (Sat. sol. in Methanol) | L | nt | nt | nt | nt | nt | >480 | >480 | ND | 1.0 | 0.02 |
| 261 | Methyl bromide | G | nt | nt | nt | nt | nt | >480 | imm. | 0.027 | 0.01 | 0.001 |
| 261 | Methyl chloride | G | >480 | >480 | ND | 0.01 | 0.001 | >480 | >480 | ND | 0.7 | 0.03 |
| 261 | Methyl iodide | L | nt | nt | nt | nt | nt | >480 | >480 | ND | 0.01 | 0.001 |
| 261 | Propylene dichloride | L | nt | nt | nt | nt | nt | >480 | >480 | <0.01 | 0.1 | 0.01 |
| 261 | 1,1,2,2-Tetrachloroethane | L | >480 | imm. | 0.005 | 0.002 | 0.0001 | >480 | >480 | ND | 1.2 | 0.016 |
| 261 | 1,1,1,2-Tetrafluoroethane | L | nt | nt | nt | nt | nt | nt | nt | nt | nt | nt |
| 261 | 1,1,2-Trichloroethane | L | nt | nt | nt | nt | nt | >480 | 339 | 0.002 | 0.01 | 0.001 |
| 261 | 1,1,1-Trichloroethane | L | >480 | >480 | ND | 0.1 | 0.004 | >480 | 169 | 0.03 | 0.06 | 0.001 |

Perm. rate = permeation rate; SDL = system detection limit; MDPR = minimum detectable permeation rate;
imm. = immediate; < = less than; > = greater than; ND = none detected; nm = not measured; nt = not tested

The Permeation Data Table above shows test results for certain chemicals in associated sub-classes as defined in ASTM F1186. Prediction of chemical resistance of a material from data on other chemicals has not been successful. However, when data is unavailable, information on related chemicals within a sub-class may at least rank alternative chemical protective materials as to their probable chemical resistance. The sub-class listings on Page 5 show related chemicals in the same ASTM F1186 sub-classes as in this Permeation Data Table.

For additional documents, call 1-800-558-9329 (1-800-55-TYFAX). Call 1-800-448-9835 (1-800-44-TYVEK) if you have a question about this information.



*Revised July 1996. Supersedes February 1996.*

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PERMEATION DATA (test method ASTM F739)

| Sub-Class | Chemical Name | Physical Phase | TYVEK® QC Average Breakthrough Time Normalized (min.) | TYVEK® QC Average Breakthrough Time Actual (min.) | TYVEK® QC Avg. Perm. Rate (µg/cm2/min.) | TYVEK® QC SDL (ppm) | TYVEK® QC MDPR (µg/cm2/min.) | TYVEK® laminated with Saranex® 23-P Average Breakthrough Time Normalized (min.) | TYVEK® laminated with Saranex® 23-P Average Breakthrough Time Actual (min.) | TYVEK® laminated with Saranex® 23-P Avg. Perm. Rate (µg/cm2/min.) | TYVEK® laminated with Saranex® 23-P SDL (ppm) | TYVEK® laminated with Saranex® 23-P MDPR (µg/cm2/min.) | TYCHEM® 7500 Average Breakthrough Time Normalized (min.) | TYCHEM® 7500 Average Breakthrough Time Actual (min.) | TYCHEM® 7500 Avg. Perm. Rate (µg/cm2/min.) | TYCHEM® 7500 SDL (ppm) | TYCHEM® 7500 MDPR (µg/cm2/min.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 280 | 1,1-Dimethylhydrazine | L | nt | nt | nt | nt | nt | nm | 12 | imm. | 0.5 | nm | nt | nt | nt | nt | nt |
| 280 | Hydrazine | L | nt | nt | nt | nt | nt | nm | >480 | ND | 1.0 | 1.0 | nt | nt | nt | nt | nt |
| 280 | Hydrazine hydrate, 50% | L | nt | nt | nt | nt | nt | nt | nt | nt | nt | nt | nt | nt | nt | nt | nt |
| 280 | Methyl hydrazine | L | nt | nt | nt | nt | nt | nt | nt | nt | nt | nt | nt | nt | nt | nt | nt |

Perm. rate = permeation rate; SDL = system detection limit; MDPR = minimum detectable permeation rate;
imm. = immediate; < = less than; > = greater than; ND = none detected; nm = not measured; nt = not tested

The Permeation Data Table above shows test results for certain chemicals in associated sub-classes as defined in ASTM F1186. Prediction of chemical resistance of a material from data on other chemicals has not been successful. However, when data is unavailable, information on related chemicals within a sub-class may at least rank alternative chemical protective materials as to their probable chemical resistance. The sub-class listings below show related chemicals in the same ASTM F1186 sub-classes as in this Permeation Data Table.

**Sub-Class 280 Hydrazines**

| | |
|---|---|
| Dimethylhydrazine | Hydrazobenzene |
| 1,1-Dimethylhydrazine | Methylhydrazine |
| Hydrazine | Phenyl hydrazine |
| Hydrazine hydrate | |


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PERMEATION DATA (test method ASTM F739)

| Sub-Class | Chemical Name | Physical Phase | TYCHEM® 9400 Average Breakthrough Time Normalized (min.) | TYCHEM® 9400 Average Breakthrough Time Actual (min.) | TYCHEM® 9400 Avg. Perm. Rate (µg/cm2/min.) | TYCHEM® 9400 SDL (ppm) | TYCHEM® 9400 MDPR (µg/cm2/min.) | TYCHEM® 10,000 Average Breakthrough Time Normalized (min.) | TYCHEM® 10,000 Average Breakthrough Time Actual (min.) | TYCHEM® 10,000 Avg. Perm. Rate (µg/cm2/min.) | TYCHEM® 10,000 SDL (ppm) | TYCHEM® 10,000 MDPR (µg/cm2/min.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 280 | 1,1-Dimethylhydrazine | L | nm | >480 | ND | 5.0 | 5.0 | >480 | 168 | 0.007 | 0.01 | 0.001 |
| 280 | Hydrazine | L | >480 | >480 | ND | 0.05 | 0.05 | nt | nt | nt | nt | nt |
| 280 | Hydrazine hydrate, 50% | L | nt | nt | nt | nt | nt | >480 | >480 | <0.01 | 0.1 | 0.01 |
| 280 | Methyl hydrazine | L | nt | nt | nt | nt | nt | >480 | >480 | ND | 0.01 | 0.001 |

Perm. rate = permeation rate; SDL = system detection limit; MDPR = minimum detectable permeation rate;
imm. = immediate; < = less than; > = greater than; ND = none detected; nm = not measured; nt = not tested

The Permeation Data Table above shows test results for certain chemicals in associated sub-classes as defined in ASTM F1186. Prediction of chemical resistance of a material from data on other chemicals has not been successful. However, when data is unavailable, information on related chemicals within a sub-class may at least rank alternative chemical protective materials as to their probable chemical resistance. The sub-class listings below show related chemicals in the same ASTM F1186 sub-classes as in this Permeation Data Table.

**Sub-Class 280 Hydrazines**

| | |
|---|---|
| Dimethylhydrazine | Hydrazobenzene |
| 1,1-Dimethylhydrazine | Methylhydrazine |
| Hydrazine | Phenyl hydrazine |
| Hydrazine hydrate | |


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# DETERMINATION OF THE BARRIER EFFECTIVENESS OF TYVEK® 1422A, KLEENGUARD® BP, AND POLYBOND® TO ASBESTOS PENETRATION

Prepared for

Textiles Fibers Department, E.I. DuPont de Nemours & Company, Richmond, Virginia

by

Todd R. Carroll, Arthur D. Little, Inc., Cambridge, Massachusetts

JANUARY 1991

Arthur D. Little Reference No. C-60838

## 1. SUMMARY

The objectives of this study were to determine the holdout efficiencies of three nonwoven fabrics to asbestos penetration and to establish a basis of reproducibility for the penetration test method.

Arthur D. Little purchased garments of the type used as protective clothing in the asbestos abatement industry. The garments were fabricated from Tyvek® 1422A[1], KleenGuard®[2] Basic Protection, and standard PolyBond®[3]. Specimens of the garments were tested for degree of fiber penetration when challenged with a stream of asbestos-laden air. The fabrics were also characterized for fabric thickness, weight per unit area, and air permeability.

The results of this study as presented in Table 1. Mean pooled holdout efficiencies calculated at the 95% confidence interval were 98±2%, 56±14%, and 23±17%, respectively, for Tyvek 1422A, KleenGuard BP, and PolyBond; these mean holdout efficiencies are significantly different. The mean challenge concentration of asbestos ranges from 2.75-4.13x$10^7$ fibers/L.

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[1]Tyvek 1422A Spunbonded olefin is a registered trademark of the DuPont Company.
[2]KleenGuard is a registered trademark of the Kimberly-Clark Corporation.
[3]PolyBond is a trademark of Wayne-Tex, Inc.

TyFax is a trademark of DuPont.

TABLE 1. TEST RESULTS

| Fabric | Thickness* (mil) | Weight+ ($oz/yd^2$) | Air Permeability ($ft^3/ft^2/min$) | % Holdout++ Efficiency |
|---|---|---|---|---|
| Tyvek 1422A | 4.8 ± 0.5 | 1.19 ± 0.01 | <1.0 | 98 ± 2 |
| KleenGuard BP | 9.3 ± 0.5 | 1.14 ± 0.04 | 354 ± 21 | 56 ±14 |
| PolyBond | 11.6 ± 0.4 | 1.56 ± 0.04 | >704 | 23 ±17 |

* Average of five measurements made on each of 15 specimens.
\+ Average of 15, 37-mm diameter specimens.
** Average of 15 specimens at 86-mm Merrian Red Oil.
++ Mean pooled holdout efficiencies reported at the 95% confidence interval and at an average mean challenge concentration of $3.3 \pm 0.7 \times 10^7$ fibers/L; average of nine specimens.

Representative particle size distributions (i.e., histograms) of the challenge and penetrated fibers are presented in Appendix A. Appendix C contains samples of the fabrics tested along with copies of the scanning electron microscope (SEM) photomicrographs from which the holdout efficiencies were calculated.

Statistical analysis of the data (See Appendix B) supports the following conclusions:

- Holdout efficiencies do not appear to be significantly affected by challenge concentration within the range investigated in this study;
- Holdout efficiencies do not appear to be significantly affected by replication (i.e., results for a fabric can be reproduced within acceptable limits of precision); and
- The test method is capable of discriminating between holdout efficiencies of different fabrics. Significant differences in holdout efficiencies were detected among the three fabrics tested.

Caution is recommended in comparing the results of this study with those of past and future studies. Comparisons may be valid only for collection periods between 4 and 12 minutes and challenge concentrations within the range of approximately $2.75\text{-}4.13 \times 10^7$ fibers/L.

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## DISCLAIMER

This report was prepared by Arthur D. Little, Inc. for the account of E.I. DuPont de Nemours & Company (DuPont). The material in it reflects Arthur D. Little's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third party. Arthur D. Little accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

*To request a complete copy of this A. D. Little report (DuPont Brochure H35310), use Literature Request Form, TyFax Document Number 825 .*

We believe this information is the best currently available. It is subject to revision as additional knowledge and experience are gained. Du Pont makes no guarantee of results and assumes no obligation or liability in connection with this information. It is the user's responsibility to determine the level of toxicity and the proper personal protective equipment needed. The information set forth herein reflects laboratory performance of fabrics, not complete garments, under controlled conditions. It is intended for informational use by persons having the technical skill for evaluation under their specific end-use conditions at their own discretion and risk. Anyone intending to use this information should first verify that the garment selected is suitable for the intended use. Since conditions of use are outside our control, we make no warranties, express or implied, and assume no liability in connection with any use of this information. This information is not intended as a license to operate under or a recommendation to infringe any patent or technical information of DuPont or others covering any material or its use.

WARNINGS:

(1) Garments of TYVEK, Tyvek® QC, and Tyvek®/Saranex 23-P are not flame resistant and should not be used around heat, flame, sparks, or in potentially flammable or explosive environments.

(2) Garments of TYVEK Tyvek® QC, and Tyvek®/Saranex 23-P should have slip resistant or antislip materials on the outer surface of boots, shoecovers, or other garment surfaces where slipping could occur.

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# DUPONT PROTECTIVE APPAREL FABRICS LITERATURE REQUEST

## LITERATURE

| Quantity | Description | Item # |
|---|---|---|
| _____ | Cleanroom Brochure - Tyvek® fabric | H-35308 |
| _____ | Cleanroom (MPE) Reprocessing Bulletin | H-58673 |
| _____ | Tychem® Fabric Swatch Book | H-61227 |
| _____ | Tychem® Folder (empty) | H-57069 |
| _____ | Tyvek® ProtectiveWear™ Brochure | H-63954 |

## TECHNICAL DATA

| Quantity | Description | Item # |
|---|---|---|
| _____ | Barricade® Technical Data Sheet | H-57057 |
| _____ | Flammability Data | H-35313 |
| _____ | Incineration Info | H-35325 |
| _____ | Launderability Info | H-35324 |
| _____ | Permeation Guide (Rev. 1/96) | H-63966 |
| _____ | Shelf Life Data Sheet | H-35315 |
| _____ | Static Properties Data Sheet | H-35312 |
| _____ | Tychem® 7500 Technical Data Sheet | H-57060 |
| _____ | Tychem® 9400 Technical Data Sheet | H-57061 |
| _____ | Tychem® 10,000 Technical Data Sheet | H-57062 |
| _____ | TyFax™ Directory (Rev. 1/96) | H-63968 |
| _____ | Tyvek® FC (Friction Coated) Data Sheet | H-35316 |
| _____ | Tyvek® QC Technical Data Sheet | H-57058 |
| _____ | Tyvek®/Saranex® Tech. Data Sheet | H-57059 |

Maximum literature order quantity: 100

Maximum Dist. Merchandising Aids order quantity: 5

If additional quantities are needed, call 1-800-448-9835

## GENERAL INFORMATION

| Quantity | Description | Item # |
|---|---|---|
| _____ | CompuServe/SafetyNet Info Sheet | H-57074 |
| _____ | TyLine Newsletter, Vol. 2, Issue 3 | H-63965 |
| _____ | TyLine Newsletter, Vol. 3, Issue 1 | H-63971 |
| _____ | Tyvek® ProtectiveWear™ Return Auth. Form | H-63953 |
| _____ | Tyvek® Resource Conservation Brochure | H-53526 |

## DISTRIBUTOR MERCHANDISING AIDS

| Quantity | Description | Item # |
|---|---|---|
| _____ | Tyvek®/Tychem® garment slide set | H-61232 |
| _____ | Sales Video (Today's Environment, 10/94) | H-58670 |
| _____ | Tychem® 10,000 Inside Technology Video | H-63959 |

***SHIP TO:***

Name: _____

Title: _____

Company: _____

Address: _____

_____

_____

Phone: _____

Fax: _____

Note: Order cannot be delivered to a P.O. Box.

***PLEASE FAX FORM TO:***
***1-800-203-0013***

*Document 825*

*Revised Feb. 1996. Supersedes Nov. 1995.*

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# CONFINED SPACE ENTRY PROGRAM

# DANGER

# CONFINED SPACE ENTRY BY PERMIT ONLY

TP-1

## *Module Goals:*

The student goals for this module are:

1. Given a hazardous waste site, determine whether it contains any permit-required confined spaces (PRCSs) as defined by the Occupational Safety and Health Administration (OSHA).

2. Given 29 CFR 1910.146 and a PRCS, develop a PRCS program.

3. Given a PRCS, develop an entry permit.

4. Given the use of a contractor in a PRCS, coordinate entry activities.

Given 29 CFR 1910.146, define confined space.

## Confined Space

Any space which:

- Is large enough and so configured that an employee can bodily enter and perform assigned work
- Has limited or restricted means for entry or exit
- Is not designed for continuous employee occupancy

*Source:* 29 CFR 1910.146

**TP-2**

Examples of Confined Spaces

- Tanks
- Vessels
- Silos
- Storage bins
- Hoppers
- Vaults
- Pits

Given 29 CFR 1910.146, define PRCS.

## Permit-required Confined Space

A confined space that has one or more of the following characteristics:

- Contains or has the potential to contain a hazardous atmosphere
- Contains a material that has the potential for engulfing an entrant
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross section
- Contains any other recognized serious safety or health hazard

*Source:* 29 CFR 1910.146 **TP-3**

Given 29 CFR 1910.146 and a confined space, match conditions of the confined space to the PRCS criteria.

## Hazardous Atmosphere

An atmosphere that may expose employees to the risk of injury, illness, or death from one or more of the following:

- Flammable gas, vapor, or mist in excess of 10% of lower explosive limit (LEL)
- Airborne combustible dust in excess of LEL
- Oxygen concentration less than 19.5% or greater than 23.5%
- Atmospheric concentration in excess of permissible exposure limits (PELs)
- Any other atmospheric condition that is immediately dangerous to life or health (IDLH)

*Source:* 29 CFR 1910.146 **TP-4**

**Note:** Only substances that are capable of causing the following conditions are covered by this provision:

- Death
- Incapacitation
- Impairment of ability to self-rescue
- Injury
- Acute illness

For a substance for which there is no PEL, other sources of toxicity information (e.g., material safety data sheets) may be used.

Given 29 CFR 1910.146, list the 14 elements of a PRCS program.

## PRCS Program Elements

1. Prevent unauthorized entry
2. Identify and evaluate hazards prior to entry
3. Implement procedures and practices for safe entry
4. Provide needed equipment
5. Evaluate space during entry operations
6. Provide outside attendant
7. Identify procedures for multiple space monitoring by a single attendant (if necessary)
8. Designate duties and responsibilities of individuals involved in entry operations
9. Implement procedures for rescue and emergency services
10. Develop a system for preparation, issuance, use, and cancellation of entry permits
11. Coordinate entry operations with workers of other employers
12. Develop closure procedures
13. Review and correct program deficiencies as they are identified
14. Conduct annual program reviews

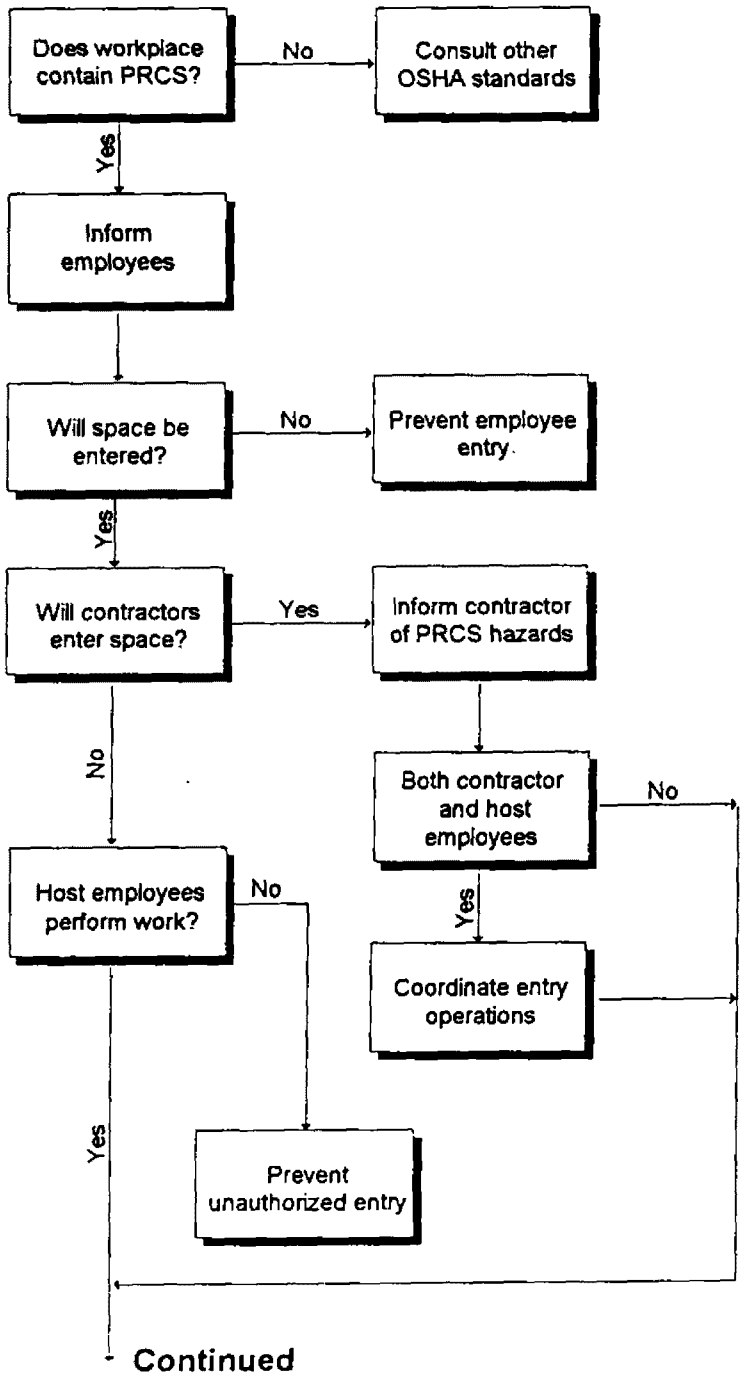
*Source:* 29 CFR 1910.146

TP-5-7

## Notes:

Given the decision logic flowchart provided in 29 CFR 1910.146, review the steps taken in a PRCS program to ensure worker protection.

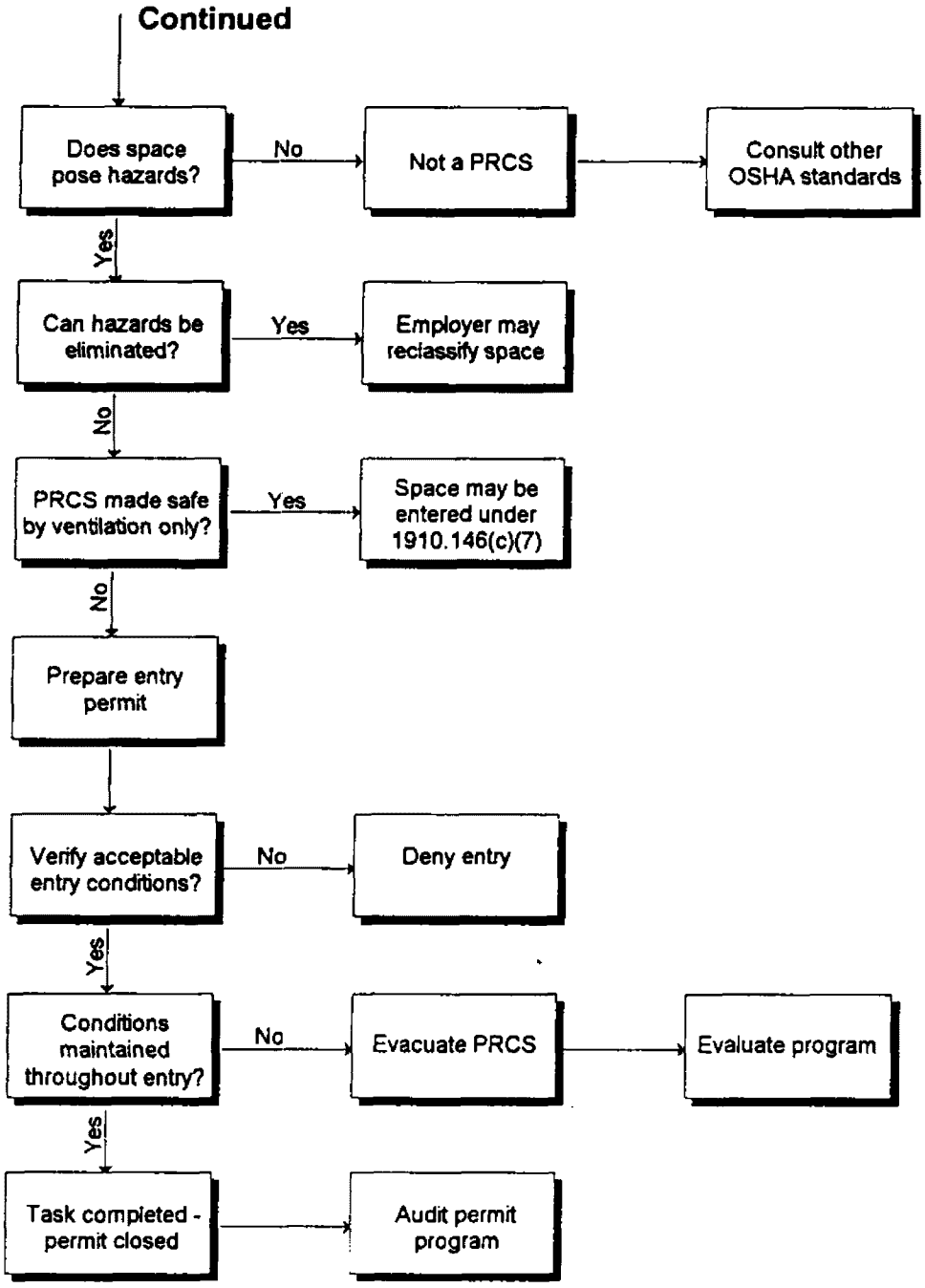
# Confined Space Decision Flowchart




Continued

*Adapted from:* 29 CFR 1910.146, Appendix A

# Confined Space Decision Flowchart (cont.)




*Adapted from:* 29 CFR 1910.146, Appendix A

Given 29 CFR 1910.146, define entry permit.

## Entry Permit Definition

- Written or printed _____ that is provided by the employer to allow and control entry into a permit space
- Contains the information specified in paragraph (f) — Entry Permit

*Source:* 29 CFR 1910.146

Given 29 CFR 1910.146 and a PRCS, apply the 15 components of the entry permit.

## Required Information for an Entry Permit

1. Identification of space to be entered
2. Purpose of entry
3. Date and authorized duration of entry permit
4. List of authorized entrants for duration of permit
5. Names of personnel serving as attendants
6. Name of entry supervisor
7. Hazards of space to be entered
8. Measures used to isolate space and to eliminate or control hazards before entry
9. Acceptable entry conditions
10. Initial and periodic testing results along with names or initials of testers and times of testing
11. Rescue and emergency services to be summoned and the means for doing so
12. Communication procedures between entrants and attendants
13. Necessary equipment
14. Any other information necessary to ensure worker safety
15. Any additional required permits

*Source:* 29 CFR 1910.146

TP-8-9

Given the use of a contractor in a PRCS and the host and contractor PRCS programs, compare the elements of the two programs.

## Contractor Coordination: Contractor's Responsibilities

- Obtain information on permit space hazards and entry operations from host employer
- Coordinate entry operations with host employer (includes work near permit spaces)
- Inform host employer of contractor's permit space entry program
- Inform host employer of any hazards confronted or created during entry operations

*Source:* 29 CFR 1910.146 **TP-10**

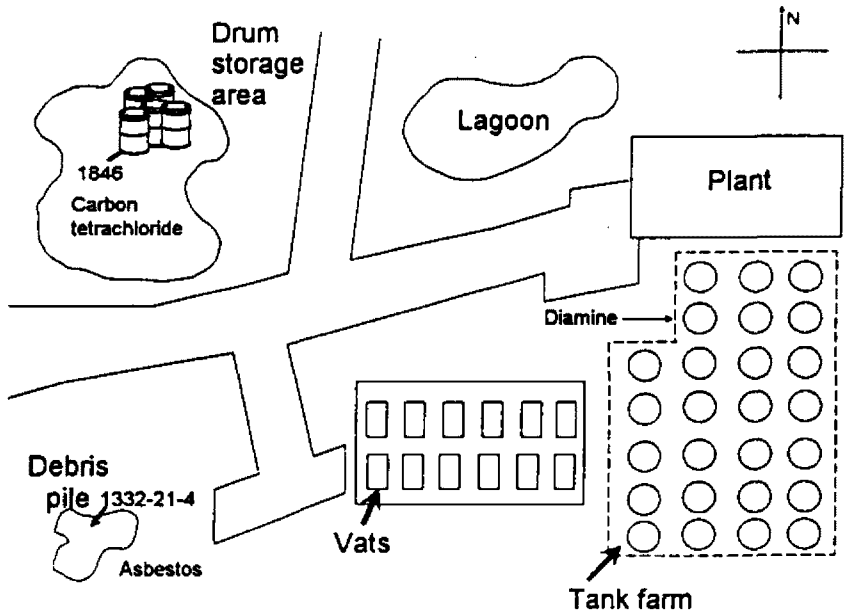
# Contractor Coordination: Host Employer's Responsibilities

- Inform contractor of permit spaces and need for permit program
- Inform contractor of identified hazards and previous experience with the space
- Inform contractor of precautions or procedures implemented in or near permit spaces for employee protection
- Coordinate entry operations with contractor
- Debrief contractor to incorporate lessons learned

*Source:* 29 CFR 1910.146

**TP-11**

# The Blue Ridge Chemical Facility




**TP-12**

Scenario

There is a tank farm onsite that must be removed; therefore, each tank must be:

1. Drained.
2. Cleaned.
3. Verified nonexplosive.
4. Cut into segments.

These tanks contain diamine (anhydrous hydrazine).

The host is responsible for performing all valve lineups, draining or pumping tanks, isolating vessels, and performing air monitoring.

The contractor is responsible for cleaning and cutting tanks into segments. **Assume that this will require entry into a PRCS.**

Tasks to be performed

1. Decide on necessary monitoring procedures before and during entry (permit item 10).
2. Develop information needed for permit items 7, 8, and 9.
3. Develop plans for summoning onsite rescue and emergency services and the means for doing so (permit item 11).
4. Develop plans for summoning offsite rescue and emergency services and the means for doing so (permit item 11).
5. Identify communication procedures you will implement during entry (permit item 12).

DANGER
CONFINED SPACE ENTRY BY PERMIT ONLY

# Conclusion

DANGER
CONFINED SPACE ENTRY BY PERMIT ONLY

- **Confined Space Entry Program**
- Spill Containment Program
- Emergency Response Plans

**TP-13**

## Crossword Puzzle

### Across

25. One of its characteristics is limited means of access (2 words)

### Down

5. The person who functions as a safety observer for entrants into a PRCS
6. A 15-component document that authorizes entries into a PRCS is an _____ permit

# APPENDIX A
## Confined Space Scenario

# Confined Space Senario

**FACE 85-05: Confined Space Incident Kills Two workers - Company Employee and Rescuing Fireman**

## INTRODUCTION

On November 15, 1984, one worker died after entering a toluene storage tank. During the rescue attempt, a fireman was killed when the tank exploded.

## SYNOPSIS OF EVENTS

The owner of a bulk petroleum storage facility discovered that the toluene storage tank (10 feet in diameter and 20 feet in height) was contaminated and would have to be drained and cleaned. Since the tank's only access portal was located on top of the upright cylindrical tank, the owner decided to have a clean-out access portal installed at the bottom of the tank when emptied. A contractor was called to provide cost estimates for installing the portal. The contractor performed a site survey of the tank and told the owner that the tank must be drained, all sludge removed, and thoroughly ventilated before he would install the portal. The owner directed his maintenance supervisor to get the tank prepared for the contractor.

On the day of the incident the supervisor and an unskilled laborer (a San Salvadorean immigrant on his first day back on the job after working another job for approximately 2 months) drained the tank to its lowest level - leaving 2 to 3 inches of sludge and toluene in the bottom - and prepared for a "dry run" of entry into the tank via the top access portal.

The supervisor rented a self-contained breathing apparatus (SCBA) from a local rental store and instructed the laborer in use of the SCBA and in the procedure they intended to follow. Since a ladder would not fit into the 16-inch diameter access hole, the supervisor secured a knotted, 1/4-inch rope to the vent pipe on top of the tank and lowered the rope into the hole. The 16-inch diameter opening on the top of the tank was not large enough to permit the laborer to enter wearing the SCBA. Therefore, it was decided the SCBA would be loosely strapped to the laborer so it could be held over his head until he cleared the opening. Once entry had been made, the supervisor was to lower the SCBA onto the laborer's back so it could be properly secured.

Immediately prior to the incident, both employees were on top of the tank. The laborer was sitting at the edge of the opening. The supervisor turned to pick up the SCBA. While he was picking up the unit, he heard the laborer in the tank. He turned and looked into the opening and saw the laborer standing at the bottom of the tank. He told the laborer to come out of the tank, but there was no response. The supervisor bumped the rope against the laborer's chest attempting to get his attention. The laborer was mumbling, but was still not responding to his supervisor's commands. At this point, the supervisor pulled the rope out of the tank, tied the SCBA to it and lowered the unit into the tank. Again, he yelled to the laborer in the tank, bumped him with the unit and told him to put the mask on. There was still no response. The laborer fell to his knees, then fell onto his back, and continued to mumble. At this point, the supervisor told the facility manager (who was on the ground) to call the fire department.

The first call went to the police department who relayed it to the fire department. Included in the fire department response was the hazardous materials team, due to the information received about the

material in the tank. The fire department (including the rescue and the hazardous materials teams) arrived on the scene approximately 10 minutes after the initial notification. After apprising the situation, fire officials decided to implement a rescue procedure rather than a hazardous materials procedure. Therefore, removal of the disabled person inside the tank was given top priority.

The 16-inch diameter opening at the top of the tank was not large enough to lower a fireman donned in full rescue gear. Therefore, it was decided to cut through the side of the tank to remove the victim. The firemen were aware of the contents of the tank (toluene) and the possibility of an explosion.

The procedure developed by the fire department involved making two 19-inch vertical cuts and a 19-inch horizontal cut with a gasoline-powered disc saw. After the cuts were completed, the steel flap would be pulled down and the victim removed.

While the hazardous materials team was cutting, other firemen were spraying water on the saw from the exterior to quench sparks. Two other firemen were spraying water on the interior cut from the top opening. Three firemen with the hazardous materials team were doing the actual cutting; they were alternately operating the saw because of the effort required to cut through the 1/4-inch thick steel. Sometime during the horizontal cut a decision was made to bring the two firemen off the top, which meant no water spray on the interior. Simultaneously, the exterior water spray was removed to put out flammable liquid burning on the ground as a result of the shower of sparks from the saw. Thus, at the precise time of the explosion, no water was being sprayed on the saw/cut from exterior or interior. Both vertical cuts were completed and the horizontal cut was 95 percent complete when the explosion occurred.

One fireman was killed instantly from the explosion and several were injured. The man inside the tank was presumed to be already dead at the time of the explosion.

## CONCLUSIONS/RECOMMENDATIONS

The conclusions and recommendations are presented in two parts: Part I - the confined space entry; and Part II - the rescue effort.

Part I - Confined Space Entry:

The following factors may have contributed to the confined space fatality:

The company had no confined space entry procedures.

The supervisor was not qualified to direct confined space entry.

The laborer was inadequately trained for confined space entry – possible language barrier.

Appropriate protective clothing and equipment were not provided.

The only access portal required vertical entry.

The access portal was small.

It was the laborer's first day back on the job. (He may have felt obligated to perform any task assigned.)

## RECOMMENDATIONS

Written confined space entry procedures should be developed and used. Procedures should contain the following: permit system, testing and monitoring of the atmosphere, training of employees, safety equipment/ clothing, safe work practices, rescue procedures, standby person requirements, and use of respiratory protection.

Selection of proper respiratory protection – whether it be a self-contained breathing apparatus (SCBA) or supplied air system – is essential. Selection should be determined by the physical limitations, equipment available, and work procedures.

Confined space testing and evaluation by a qualified person before entry and implementation of safety measures will help reduce risk-taking by employees.

Vertical access from the top of a 20-foot tank by a rope was found to be physically impossible while wearing respiratory protection and protective clothing. An additional access port on the side near ground level would eliminate this problem. The port should be of adequate size to permit entry of a worker wearing full protective clothing.

Workers must be properly trained (in English, Spanish, or the prevailing language) in confined space entry procedures and use of personal protective equipment. Also, the tank contents and known potential hazards should be discussed.

A prior accident should have alerted someone that additional protection was needed. If entry procedures are being followed and an accident occurs, it is necessary to reevaluate the procedures and make necessary corrections for employee safety.

Part II - The Rescue Effort:

The following factors may have contributed to the rescue effort fatality and injuries:

The condition of the person down inside the tank was not known.

The location and size of the only access portal on the tank precluded entry by a rescuer wearing full protective clothing and equipment.

The fire department's confined space entry procedures precluded entry into a confined space containing hazardous materials without full protective clothing and equipment.

The choice of methods to open the tank for rescue entry introduced an ignition source to an atmosphere which was known to be potentially explosive (see tank calculations).

The use of water sprays to prevent ignition of a flammable/explosive atmosphere in a confined space may not be effective under certain conditions.

There were combustible materials on the ground surrounding the tank which ignited prior to the explosion and necessitated removal of exterior water spray away from the saw/cut.

The fire department chain of command possibly created confusion when orders were given without full knowledge of the situation.

The number of fire department personnel in the immediate area may have been excessive.

The victim (fire fighter) was directly in front of the cut during the cutting procedure and when the explosion occurred.

## RECOMMENDATIONS

While cutting the tank and assisting fellow firemen who were cutting, one fire fighter stood directly in front of the opening, rather than to the side. This maximized the impact the victim received from the explosion. It is recommended that procedures be outlined that minimize such risk by firemen.

When hazardous tasks are performed only essential personnel should be in the immediate area, regardless of perceived risk by fire fighters. Nonessential personnel should be permitted only after the hazardous task(s) has been completed.

More extensive departmental procedures for efforts involving responses to explosive environments and hazardous materials are needed. Procedures should include command responsibilities, determinations of and distinctions between rescue and recovery efforts, uses of potential sources of ignition, methods to minimize risks of ignitions, etc.

City fire departments should establish a registry of confined spaces and toxic/explosive substances for specific companies within the area in which they serve. Such a registry should provide not only the name of the substance, but should also provide sufficient information so that emergency response personnel will have one comprehensive source that provides information sufficient to safely effect a rescue effort.

Research is needed to determine the best methods (if any) to gain entry in such circumstances. Cutting may be too hazardous, even with the use of water sprays.

This case was taken from the book *Worker Deaths in Confined Spaces*, which is available from:

Publications Dissemination, DSDTT
NIOSH
4676 Columbia Parkway
Cincinnati, OH 45226-1998
FAX: (513) 533-8573

# APPENDIX B

29 CFR 1910.146

Permit-required Confined Spaces

**§1910.146 - Permit-required confined spaces [Para (a) thru (e)(2)]**
STANDARD NUMBER: 1910.146
STANDARD TITLE: Permit-required confined spaces
SUBPART NUMBER: J
SUBPART TITLE: General Environmental Controls
TEXT:
(a) *Scope and application.* This section contains requirements for practices and procedures to protect employees in general industry from the hazards of entry into permit-required confined spaces. This section does not apply to agriculture, to construction, or to shipyard employment (Parts 1928, 1926, and 1915 of this chapter, respectively).
(b) *Definitions.*
*Acceptable entry conditions* means the conditions that must exist in a permit space to allow entry and to ensure that employees involved with a permit-required confined space entry can safely enter into and work within the space.

*Attendant* means an individual stationed outside one or more permit spaces who monitors the authorized entrants and who performs all attendant's duties assigned in the employer's permit space program.

*Authorized entrant* means an employee who is authorized by the employer to enter a permit space.

*Blanking or blinding* means the absolute closure of a pipe, line, or duct by the fastening of a solid plate (such as a spectacle blind or a skillet blind) that completely covers the bore and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate.

*Confined space* means a space that:

(1) Is large enough and so configured that an employee can bodily enter and perform assigned work; and

(2) Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.); and

(3) Is not designed for continuous employee occupancy.

*Double block and bleed* means the closure of a line, duct, or pipe by closing and locking or tagging two in-line valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves.

*Emergency* means any occurrence (including any failure of hazard control or monitoring equipment) or event internal or external to the permit space that could endanger entrants.

*Engulfment* means the surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.

*Entry* means the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

*Entry permit* (permit) means the written or printed document that is provided by the employer to allow and control entry into a permit space and that contains the information specified in paragraph (f) of this section.

*Entry supervisor* means the person (such as the employer, foreman, or crew chief) responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry as required by this section.

NOTE: An entry supervisor also may serve as an attendant or as an authorized entrant, as long as that person is trained and equipped as required by this section for each role he or she fills. Also, the duties of entry supervisor may be passed from one individual to another during the course of an entry operation.

*Hazardous atmosphere* means an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from a permit space), injury, or acute illness from one or more of the following causes:

(1) Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL);

(2) Airborne combustible dust at a concentration that meets or exceeds its LFL;

NOTE: This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet (1.52 m) or less.

(3) Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;

(4) Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in Subpart G, Occupational Health and Environmental Control, or in Subpart Z, Toxic and Hazardous Substances, of this Part and which could result in employee exposure in excess of its dose or permissible exposure limit;

NOTE: An atmospheric concentration of any substance that is not capable of causing death, incapacitation, impairment of ability to self-rescue, injury, or acute illness due to its health effects is not covered by this provision.

(5) Any other atmospheric condition that is immediately dangerous to life or health.

NOTE: For air contaminants for which OSHA has not determined a dose or permissible exposure limit, other sources of information, such as Material Safety Data Sheets that comply with the Hazard Communication Standard, section 1910.1200 of this Part, published information, and internal documents can provide guidance in establishing acceptable atmospheric conditions.

*Hot work permit* means the employer's written authorization to perform operations (for example, riveting, welding, cutting, burning, and heating) capable of providing a source of ignition.

*Immediately dangerous to life or health* (IDLH) means any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit space.

NOTE: Some materials — hydrogen fluoride gas and cadmium vapor, for example — may produce immediate transient effects that, even if severe, may pass without medical attention, but are followed by sudden, possibly fatal collapse 12-72 hours after exposure. The victim "feels normal" from recovery from transient effects until collapse. Such materials in hazardous quantities are considered to be "immediately" dangerous to life or health.

*Inerting* means the displacement of the atmosphere in a permit space by a noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible.

NOTE: This procedure produces an IDLH oxygen-deficient atmosphere.

*Isolation* [58 FR 4549, Jan. 14, 1993; 58 FR 34846, June 29, 1993] means the process by which a permit space is removed from service and completely protected against the release of energy and material into the space by such means as: blanking or blinding; misaligning or removing sections of lines, pipes, or ducts; a double block and bleed system; lockout or tagout of all sources of energy; or blocking or disconnecting all mechanical linkages.

*Line breaking* means the intentional opening of a pipe, line, or duct that is or has been carrying flammable, corrosive, or toxic material, an inert gas, or any

fluid at a volume, pressure, or temperature capable of causing injury.

*Non-permit confined space* means a confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

*Oxygen deficient atmosphere* means an atmosphere containing less than 19.5 percent oxygen by volume.

*Oxygen enriched atmosphere* means an atmosphere containing more than 23.5 percent oxygen by volume.

*Permit-required confined space* (permit space) means a confined space that has one or more of the following characteristics:

(1) Contains or has a potential to contain a hazardous atmosphere;

(2) Contains a material that has the potential for engulfing an entrant;

(3) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or

(4) Contains any other recognized serious safety or health hazard.

*Permit-required confined space program* (permit space program) means the employer's overall program for controlling, and, where appropriate, for protecting employees from, permit space hazards and for regulating employee entry into permit spaces.

*Permit system* means the employer's written procedure for preparing and issuing permits for entry and for returning the permit space to service following termination of entry.

*Prohibited condition* means any condition in a permit space that is not allowed by the permit during the period when entry is authorized.

*Rescue service* means the personnel designated to rescue employees from permit spaces.

*Retrieval system* means the equipment (including a retrieval line, chest or full-body harness, wristlets, if appropriate, and a lifting device or anchor) used for non-entry rescue of persons from permit spaces.

*Testing* means the process by which the hazards that may confront entrants of a permit space are identified and evaluated. Testing includes specifying the tests that are to be performed in the permit space.

NOTE: Testing enables employers both to devise and implement adequate control measures for the protection of authorized entrants and to determine if acceptable entry conditions are present immediately prior to, and during, entry.

**1910.146(c)**

(c) General requirements. (1) The employer shall evaluate the workplace to determine if any spaces are permit-required confined spaces.

NOTE: Proper application of the decision flow chart in Appendix A to section 1910.146 would facilitate compliance with this requirement.

(2) If the workplace contains permit spaces, the employer shall inform exposed employees, by posting danger signs or by any other equally effective means, of the existence and location of and the danger posed by the permit spaces.

NOTE: A sign reading DANGER — PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER or using other similar language would satisfy the requirement for a sign.

(3) If the employer decides that its employees will not enter permit spaces, the employer shall take effective measures to prevent its employees from entering the permit spaces and shall comply with paragraphs (c)(1), (c)(2), (c)(6), and (c)(8) of this section.

**1910.146(c)(4)**

(4) If the employer decides that its employees will enter permit spaces, the employer shall develop and implement a written permit space program that complies with this section. The written program shall be available for inspection by employees and their authorized representatives.

(5) An employer may use the alternate procedures specified in paragraph (c)(5)(ii) of this section for entering a permit space under the conditions set forth in paragraph (c)(5)(i) of this section.

(i) An employer whose employees enter a permit space need not comply with paragraphs (d) through (f) and (h) through (k) of this section, provided that:

(A) The employer can demonstrate that the only hazard posed by the permit space is an actual or potential hazardous atmosphere;

(B) The employer can demonstrate that continuous forced air ventilation alone is sufficient to maintain that permit space safe for entry;

(C) The employer develops monitoring and inspection data that supports the demonstrations required by paragraphs (c)(5)(i)(A) and (c)(5)(i)(B) of this section;

(D) If an initial entry of the permit space is necessary to obtain the data required by paragraph (c)(5)(i)(C) of this section, the entry is performed in compliance with paragraphs (d) through (k) of this section;

**1910.146(c)(5)(i)(E)**

(E) The determinations and supporting data required by paragraphs (c)(5)(i)(A), (c)(5)(i)(B), and (c)(5)(i)(C) of this section are documented by the employer and are made available to each employee who enters the permit space under the terms of paragraph (c)(5) of this section; and

(F) Entry into the permit space under the terms of paragraph (c)(5)(i) of this section is performed in accordance with the requirements of paragraph (c)(5)(ii) of this section.

NOTE: See paragraph (c)(7) of this section for reclassification of a permit space after all hazards within the space have been eliminated.

(ii) The following requirements apply to entry into permit spaces that meet the conditions set forth in paragraph (c)(5)(i) of this section.

(A) Any conditions making it unsafe to remove an entrance cover shall be eliminated before the cover is removed.

(B) When entrance covers are removed, the opening shall be promptly guarded by a railing, temporary cover, or other temporary barrier that will prevent an accidental fall through the opening and that will protect each employee working in the space from foreign objects entering the space.

**1910.146(c)(5)(ii)(C)**

(C) Before an employee enters the space, the internal atmosphere shall be tested, with a calibrated direct-reading instrument, for the following conditions in the order given:

{1} Oxygen content,

{2} Flammable gases and vapors, and

{3} Potential toxic air contaminants.

(D) There may be no hazardous atmosphere within the space whenever any employee is inside the space.

(E) Continuous forced air ventilation shall be used, as follows:

{1} An employee may not enter the space until the forced air ventilation has eliminated any hazardous atmosphere;

{2} The forced air ventilation shall be so directed as to ventilate the immediate areas where an employee is or will be present within the space and shall continue until all employees have left the space;

{3} The air supply for the forced air ventilation shall be from a clean source and may not increase the hazards in the space.

(F) The atmosphere within the space shall be periodically tested as necessary to ensure that the continuous forced air ventilation is preventing the accumulation of a hazardous atmosphere.

**1910.146(c)(5)(ii)(G)**

(G) If a hazardous atmosphere is detected during entry:

{1} Each employee shall leave the space immediately;

{2} The space shall be evaluated to determine how the hazardous atmosphere developed; and

{3} Measures shall be implemented to protect employees from the hazardous atmosphere before any subsequent entry takes place.

(H) The employer shall verify that the space is safe for entry and that the pre-entry measures required by paragraph (c)(5)(ii) of this section have been taken, through a written certification that contains the date, the location of the space, and the signature of the person providing the certification. The certification shall be made before entry and shall be made available to each employee entering the space.

(6) When there are changes in the use or configuration of a non-permit confined space that might increase the hazards to entrants, the employer shall reevaluate that space and, if necessary, reclassify it as a permit-required confined space.

(7) A space classified by the employer as a permit-required confined space may be reclassified as a non-permit confined space under the following procedures:

**1910.146(c)(7)(i)**

(i) If the permit space poses no actual or potential atmospheric hazards and if all hazards within the space are eliminated without entry into the space, the permit space may be reclassified as a non-permit confined space for as long as the non-atmospheric hazards remain eliminated.

(ii) If it is necessary to enter the permit space to eliminate hazards, such entry shall be performed under paragraphs (d) through (k) of this section. If testing and inspection during that entry demonstrate that the hazards within the permit space have been eliminated, the permit space may be reclassified as a non-permit confined space for as long as the hazards remain eliminated.

NOTE: Control of atmospheric hazards through forced air ventilation does not constitute elimination of the hazards. Paragraph (c)(5) covers permit space entry where the employer can demonstrate that forced air ventilation alone will control all hazards in the space.

(iii) The employer shall document the basis for determining that all hazards in a permit space have been eliminated, through a certification that contains the date, the location of the space, and the signature of the person making the determination. The certification shall be made available to each employee entering the space.

**1910.146(c)(7)(iv)**

(iv) If hazards arise within a permit space that has been declassified to a non-permit space under paragraph (c)(7) of this section, each employee in the space shall exit the space. The employer shall then reevaluate the space and determine whether it must be reclassified as a permit space, in accordance with other applicable provisions of this section.

(8) When an employer (host employer) arranges to have employees of another employer (contractor) perform work that involves permit space entry, the host employer shall:

(i) Inform the contractor that the workplace contains permit spaces and that permit space entry is allowed only through compliance with a permit space program meeting the requirements of this section;

(ii) Apprise the contractor of the elements, including the hazards identified and the host employer's experience with the space, that make the space in question a permit space;

(iii) Apprise the contractor of any precautions or procedures that the host employer has implemented for the protection of employees in or near permit spaces where contractor personnel will be working;

(iv) Coordinate entry operations with the contractor, when both host employer personnel and contractor personnel will be working in or near permit spaces, as required by paragraph (d)(11) of this section; and

**1910.146(c)(8)(v)**

(v) Debrief the contractor at the conclusion of the entry operations regarding the permit space program followed and regarding any hazards confronted or created in permit spaces during entry operations.

(9) In addition to complying with the permit space requirements that apply to all employers, each contractor who is retained to perform permit space entry operations shall:

(i) Obtain any available information regarding permit space hazards and entry operations from the host employer;

(ii) Coordinate entry operations with the host employer, when both host employer personnel and contractor personnel will be working in or near permit spaces, as required by paragraph (d)(11) of this section; and

(iii) Inform the host employer of the permit space program that the contractor will follow and of any hazards confronted or created in permit spaces, either through a debriefing or during the entry operation.

(d) Permit-required confined space program (permit space program). Under the permit space program required by paragraph (c)(4) of this section, the employer shall:

(1) Implement the measures necessary to prevent unauthorized entry;

**1910.146(d)(2)**

(2) Identify and evaluate the hazards of permit spaces before employees enter them;

(3) Develop and implement the means, procedures, and practices necessary for safe permit space entry operations, including, but not limited to, the following:

(i) Specifying acceptable entry conditions;

(ii) Isolating the permit space;

(iii) Purging, inerting, flushing, or ventilating the permit space as necessary to eliminate or control atmospheric hazards;

(iv) Providing pedestrian, vehicle, or other barriers as necessary to protect entrants from external hazards; and

(v) Verifying that conditions in the permit space are acceptable for entry throughout the duration of an authorized entry.

(4) Provide the following equipment (specified in paragraphs (d)(4)(i) through (d)(4)(ix) of this section) at no cost to employees, maintain that equipment properly, and ensure that employees use that equipment properly:

(i) Testing and monitoring equipment needed to comply with paragraph (d)(5) of this section;

**1910.146(d)(4)(ii)**

(ii) Ventilating equipment needed to obtain acceptable entry conditions;

(iii) Communications equipment necessary for compliance with paragraphs (h)(3) and (i)(5) of this section;

(iv) Personal protective equipment insofar as feasible engineering and work practice controls do not adequately

protect employees;

(v) Lighting equipment needed to enable employees to see well enough to work safely and to exit the space quickly in an emergency;

(vi) Barriers and shields as required by paragraph (d)(3)(iv) of this section;

(vii) Equipment, such as ladders, needed for safe ingress and egress by authorized entrants;

(viii) Rescue and emergency equipment needed to comply with paragraph (d)(9) of this section, except to the extent that the equipment is provided by rescue services; and

(ix) Any other equipment necessary for safe entry into and rescue from permit spaces.

(5) Evaluate permit space conditions as follows when entry operations are conducted:

**1910.146(d)(5)(i)**

(i) Test conditions in the permit space to determine if acceptable entry conditions exist before entry is authorized to begin, except that, if isolation of the space is infeasible because the space is large or is part of a continuous system (such as a sewer), pre-entry testing shall be performed to the extent feasible before entry is authorized and, if entry is authorized, entry conditions shall be continuously monitored in the areas where authorized entrants are working;

(ii) Test or monitor the permit space as necessary to determine if acceptable entry conditions are being maintained during the course of entry operations; and

(iii) When testing for atmospheric hazards, test first for oxygen, then for combustible gases and vapors, and then for toxic gases and vapors.

NOTE: Atmospheric testing conducted in accordance with Appendix B to section 1910.146 would be considered as satisfying the requirements of this paragraph. For permit space operations in sewers, atmospheric testing conducted in accordance with Appendix B, as supplemented by Appendix E to section 1910.146, would be considered as satisfying the requirements of this paragraph.

**1910.146(d)(6)**

(6) Provide at least one attendant outside the permit space into which entry is authorized for the duration of entry operations;

NOTE: Attendants may be assigned to monitor more than one permit space provided the duties described in paragraph (i) of this section can be effectively performed for each permit space that is monitored. Likewise, attendants may be stationed at any location outside the permit space to be monitored as long as the duties described in paragraph (i) of this section can be effectively performed for each permit space that is monitored.

(7) If multiple spaces are to be monitored by a single attendant, include in the permit program the means and procedures to enable the attendant to respond to an emergency affecting one or more of the permit spaces being monitored without distraction from the attendant's responsibilities under paragraph (i) of this section;

(8) Designate the persons who are to have active roles (as, for example, authorized entrants, attendants, entry supervisors, or persons who test or monitor the atmosphere in a permit space) in entry operations, identify the duties of each such employee, and provide each such employee with the training required by paragraph (g) of this section;

**1910.146(d)(9)**

(9) Develop and implement procedures for summoning rescue and emergency services, for rescuing entrants from permit spaces, for providing necessary emergency services to rescued employees, and for preventing unauthorized personnel from attempting a rescue;

(10) Develop and implement a system for the preparation, issuance, use, and cancellation of entry permits as required by this section;

(11) Develop and implement procedures to coordinate entry operations when employees of more than one employer are working simultaneously as authorized entrants in a permit space, so that employees of one employer do not endanger the employees of any other employer;

(12) Develop and implement procedures (such as closing off a permit space and canceling the permit) necessary for concluding the entry after entry operations have been completed;

(13) Review entry operations when the employer has reason to believe that the measures taken under the permit space program may not protect employees and revise the program to correct deficiencies found to exist before subsequent entries are authorized; and

NOTE: Examples of circumstances requiring the review of the permit space program are: any unauthorized entry of a permit space, the detection of a permit space hazard not covered by the permit, the detection of a condition prohibited by the permit, the occurrence of an injury or near-miss during entry, a change in the use or configuration of a permit space, and employee complaints about the effectiveness of the program.

**1910.146(d)(14)**

(14) Review the permit space program, using the canceled permits retained under paragraph (e)(6) of this section within 1 year after each entry and revise the program as necessary, to ensure that employees participating in entry operations are protected from permit space hazards.

NOTE: Employers may perform a single annual review covering all entries performed during a 12-month period. If no entry is performed during a 12-month period, no review is necessary.

Appendix C to section 1910.146 presents examples of permit space programs that are considered to comply with the requirements of paragraph (d) of this section.

(e) Permit system. (1) Before entry is authorized, the employer shall document the completion of measures required by paragraph (d)(3) of this section by preparing an entry permit.

NOTE: Appendix D to section 1910.146 presents examples of permits whose elements are considered to comply with the requirements of this section.

**1910.146(e)(2)**

(2) Before entry begins, the entry supervisor identified on the permit shall sign the entry permit to authorize entry.

1910.146 - Permit-required confined spaces [Para (e)(3) thru end]

(3) The completed permit shall be made available at the time of entry to all authorized entrants, by posting it at the entry portal or by any other equally effective means, so that the entrants can confirm that pre-entry preparations have been completed.

(4) The duration of the permit may not exceed the time required to complete the assigned task or job identified on the permit in accordance with paragraph (f)(2) of this section.

(5) The entry supervisor shall terminate entry and cancel the entry permit when:

(i) The entry operations covered by the entry permit have been completed; or

(ii) A condition that is not allowed under the entry permit arises in or near the permit space.

(6) The employer shall retain each canceled entry permit for at least 1 year to facilitate the review of the permit-required confined space program

required by paragraph (d)(14) of this section. Any problems encountered during an entry operation shall be noted on the pertinent permit so that appropriate revisions to the permit space program can be made.

**1910.146(f)**

(f) Entry permit. The entry permit that documents compliance with this section and authorizes entry to a permit space shall identify:

(1) The permit space to be entered;

(2) The purpose of the entry;

(3) The date and the authorized duration of the entry permit;

(4) The authorized entrants within the permit space, by name or by such other means (for example, through the use of rosters or tracking systems) as will enable the attendant to determine quickly and accurately, for the duration of the permit, which authorized entrants are inside the permit space;

NOTE: This requirement may be met by inserting a reference on the entry permit as to the means used, such as a roster or tracking system, to keep track of the authorized entrants within the permit space.

(5) The personnel, by name, currently serving as attendants;

(6) The individual, by name, currently serving as entry supervisor, with a space for the signature or initials of the entry supervisor who originally authorized entry;

**1910.146(f)(7)**

(7) The hazards of the permit space to be entered;

(8) The measures used to isolate the permit space and to eliminate or control permit space hazards before entry;

NOTE: Those measures can include the lockout or tagging of equipment and procedures for purging, inerting, ventilating, and flushing permit spaces.

(9) The acceptable entry conditions;

(10) The results of initial and periodic tests performed under paragraph (d)(5) of this section, accompanied by the names or initials of the testers and by an indication of when the tests were performed;

(11) The rescue and emergency services that can be summoned and the means (such as the equipment to use and the numbers to call) for summoning those services;

(12) The communication procedures used by authorized entrants and attendants to maintain contact during the entry;

(13) Equipment, such as personal protective equipment, testing equipment, communications equipment, alarm systems, and rescue equipment, to be provided for compliance with this section;

**1910.146(f)(14)**

(14) Any other information whose inclusion is necessary, given the circumstances of the particular confined space, in order to ensure employee safety; and

(15) Any additional permits, such as for hot work, that have been issued to authorize work in the permit space.

(g) Training. (1) The employer shall provide training so that all employees whose work is regulated by this section acquire the understanding, knowledge, and skills necessary for the safe performance of the duties assigned under this section.

(2) Training shall be provided to each affected employee:

(i) Before the employee is first assigned duties under this section;

(ii) Before there is a change in assigned duties;

(iii) Whenever there is a change in permit space operations that presents a hazard about which an employee has not previously been trained;

(iv) Whenever the employer has reason to believe either that there are deviations from the permit space entry procedures required by paragraph (d)(3) of this section or that there are inadequacies in the employee's knowledge or use of these procedures.

**1910.146(g)(3)**

(3) The training shall establish employee proficiency in the duties required by this section and shall introduce new or revised procedures, as necessary, for compliance with this section.

(4) The employer shall certify that the training required by paragraphs (g)(1) through (g)(3) of this section has been accomplished. The certification shall contain each employee's name, the signatures or initials of the trainers, and the dates of training. The certification shall be available for inspection by employees and their authorized representatives.

(h) Duties of authorized entrants. The employer shall ensure that all authorized entrants:

(1) Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure;

(2) Properly use equipment as required by paragraph (d)(4) of this section;

(3) Communicate with the attendant as necessary to enable the attendant to monitor entrant status and to enable the attendant to alert entrants of the need to evacuate the space as required by paragraph (i)(6) of this section;

**1910.146(h)(4)**

(4) Alert the attendant whenever:

{i} The entrant recognizes any warning sign or symptom of exposure to a dangerous situation, or

{ii} The entrant detects a prohibited condition; and

(5) Exit from the permit space as quickly as possible whenever:

{i} An order to evacuate is given by the attendant or the entry supervisor,

{ii} The entrant recognizes any warning sign or symptom of exposure to a dangerous situation,

{iii} The entrant detects a prohibited condition, or

{iv} An evacuation alarm is activated.

(i) Duties of attendants. The employer shall ensure that each attendant:

(1) Knows the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure;

(2) Is aware of possible behavioral effects of hazard exposure in authorized entrants;

**1910.146(i)(3)**

(3) Continuously maintains an accurate count of authorized entrants in the permit space and ensures that the means used to identify authorized entrants under paragraph (f)(4) of this section accurately identifies who is in the permit space;

(4) Remains outside the permit space during entry operations until relieved by another attendant;

NOTE: When the employer's permit entry program allows attendant entry for rescue, attendants may enter a permit space to attempt a rescue if they have been trained and equipped for rescue operations as required by paragraph (k)(1) of this section and if they have been relieved as required by paragraph (i)(4) of this section

(5) Communicates with authorized entrants as necessary to monitor entrant status and to alert entrants of the need to evacuate the space under paragraph (i)(6) of this section;

(6) Monitors activities inside and outside the space to determine if it is safe for entrants to remain in the space and orders the authorized entrants to evacuate the permit space immediately

under any of the following conditions;

**1910.146(i)(6)(i)**

(i) If the attendant detects a prohibited condition;

(ii) If the attendant detects the behavioral effects of hazard exposure in an authorized entrant;

(iii) If the attendant detects a situation outside the space that could endanger the authorized entrants; or

(iv) If the attendant cannot effectively and safely perform all the duties required under paragraph (i) of this section;

(7) Summon rescue and other emergency services as soon as the attendant determines that authorized entrants may need assistance to escape from permit space hazards;

(8) Takes the following actions when unauthorized persons approach or enter a permit space while entry is underway:

(i) Warn the unauthorized persons that they must stay away from the permit space;

(ii) Advise the unauthorized persons that they must exit immediately if they have entered the permit space; and

(iii) Inform the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space;

**1910.146(i)(9)**

(9) Performs non-entry rescues as specified by the employer's rescue procedure; and

(10) Performs no duties that might interfere with the attendant's primary duty to monitor and protect the authorized entrants.

(j) Duties of entry supervisors. The employer shall ensure that each entry supervisor:

(1) Knows the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure;

(2) Verifies, by checking that the appropriate entries have been made on the permit, that all tests specified by the permit have been conducted and that all procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry to begin;

(3) Terminates the entry and cancels the permit as required by paragraph (e)(5) of this section;

(4) Verifies that rescue services are available and that the means for summoning them are operable;

(5) Removes unauthorized individuals who enter or who attempt to enter the permit space during entry operations; and

**1910.146(j)(6)**

(6) Determines, whenever responsibility for a permit space entry operation is transferred and at intervals dictated by the hazards and operations performed within the space, that entry operations remain consistent with terms of the entry permit and that acceptable entry conditions are maintained. (k) Rescue and emergency services. (1) The following requirements apply to employers who have employees enter permit spaces to perform rescue services.

(i) The employer shall ensure that each member of the rescue service is provided with, and is trained to use properly, the personal protective equipment and rescue equipment necessary for making rescues from permit spaces.

(ii) Each member of the rescue service shall be trained to perform the assigned rescue duties. Each member of the rescue service shall also receive the training required of authorized entrants under paragraph (g) of this section.

(iii) Each member of the rescue service shall practice making permit space rescues at least once every 12 months, by means of simulated rescue operations in which they remove dummies, manikins, or actual persons from the actual permit spaces or from representative permit spaces. Representative permit spaces shall, with respect to opening size, configuration, and accessibility, simulate the types of permit spaces from which rescue is to be performed.

**1910.146(k)(1)(iv)**

(iv) Each member of the rescue service shall be trained in basic first-aid and in cardiopulmonary resuscitation (CPR). At least one member of the rescue service holding current certification in first aid and in CPR shall be available.

(2) When an employer (host employer) arranges to have persons other than the host employer's employees perform permit space rescue, the host employer shall:

(i) Inform the rescue service of the hazards they may confront when called on to perform rescue at the host employer's facility, and

(ii) Provide the rescue service with access to all permit spaces from which rescue may be necessary so that the rescue service can develop appropriate rescue plans and practice rescue operations.

(3) To facilitate non-entry rescue, retrieval systems or methods shall be used whenever an authorized entrant enters a permit space, unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant. Retrieval systems shall meet the following requirements.

(i) Each authorized entrant shall use a chest or full body harness, with a retrieval line attached at the center of the entrant's back near shoulder level, or above the entrant's head. Wristlets may be used in lieu of the chest or full body harness if the employer can demonstrate that the use of a chest or full body harness is infeasible or creates a greater hazard and that the use of wristlets is the safest and most effective alternative.

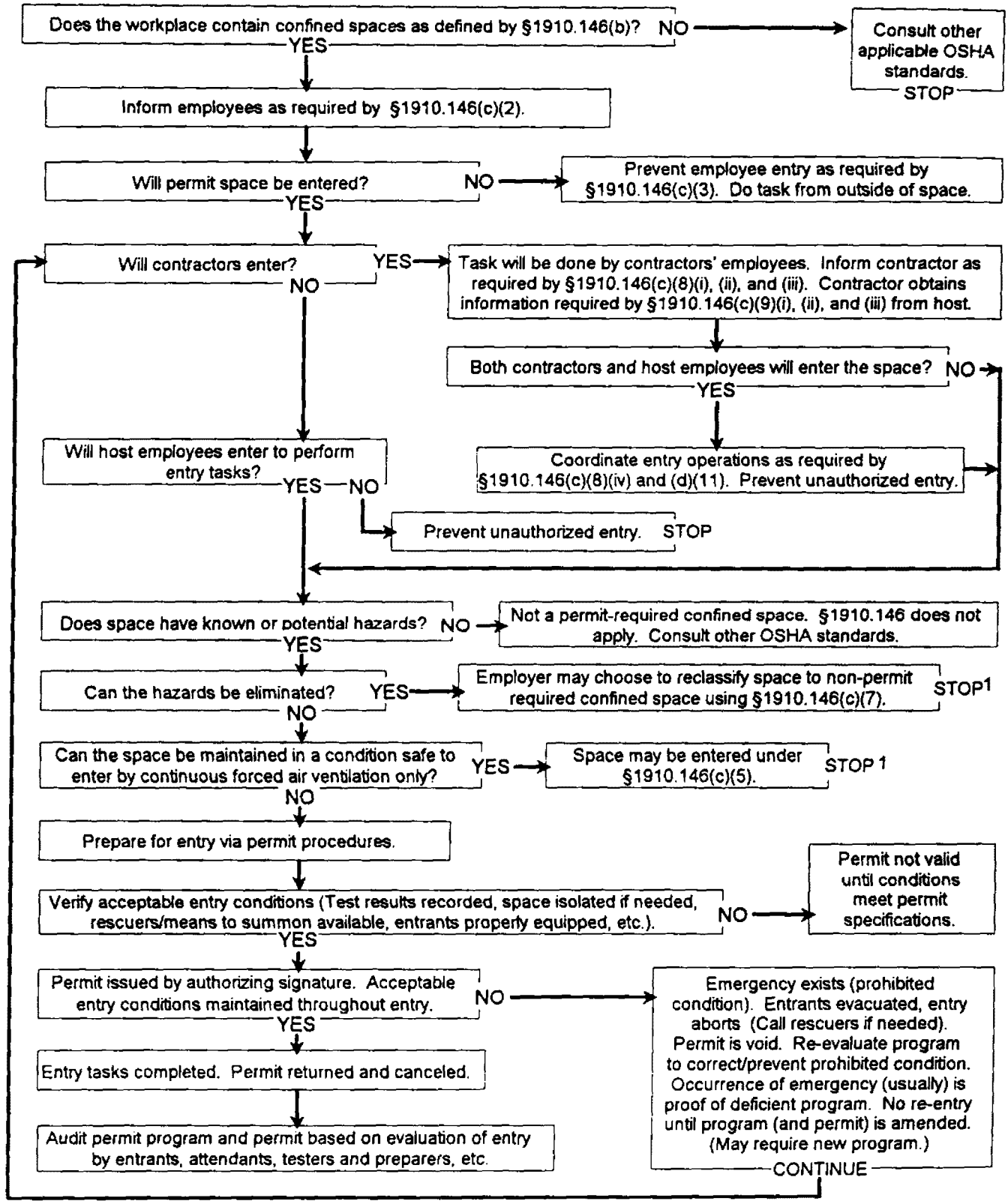
**1910.146(k)(3)(ii)**

(ii) The other end of the retrieval line shall be attached to a mechanical device or fixed point outside the permit space in such a manner that rescue can begin as soon as the rescuer becomes aware that rescue is necessary. A mechanical device shall be available to retrieve personnel from vertical type permit spaces more than 5 feet (1.52 m) deep.

(4) If an injured entrant is exposed to a substance for which a Material Safety Data Sheet (MSDS) or other similar written information is required to be kept at the worksite, that MSDS or written information shall be made available to the medical facility treating the exposed entrant.

[58 FR 4549, Jan. 14, 1993; 58 FR 34845, June 29, 1993; 59 FR 26115, May 19, 1994]

## Appendix A to §1910.146 — Permit-required Confined Space Decision Flow Chart




[1]Spaces may have to be evacuated and re-evaluated if hazards arise during entry.

**§1910.146 App B - Procedures for Atmospheric Testing.**
STANDARD NUMBER:
1910.146 App B
STANDARD TITLE : Procedures for Atmospheric Testing.
SUBPART NUMBER : J
SUBPART TITLE: General Environmental Controls
TEXT :

Atmospheric testing is required for two distinct purposes: evaluation of the hazards of the permit space and verification that acceptable entry conditions for entry into that space exist.

(1) *Evaluation testing.* The atmosphere of a confined space should be analyzed using equipment of sufficient sensitivity and specificity to identify and evaluate any hazardous atmospheres that may exist or arise, so that appropriate permit entry procedures can be developed and acceptable entry conditions stipulated for that space. Evaluation and interpretation of these data, and development of the entry procedure, should be done by, or reviewed by, a technically qualified professional (e.g., OSHA consultation service, or certified industrial hygienist, registered safety engineer, certified safety professional, certified marine chemist, etc.) based on evaluation of all serious hazards.

(2) *Verification testing.* The atmosphere of a permit space which may contain a hazardous atmosphere should be tested for residues of all contaminants identified by evaluation testing using permit specified equipment to determine that residual concentrations at the time of testing and entry are within the range of acceptable entry conditions. Results of testing (i.e., actual concentration, etc.) should be recorded on the permit in the space provided adjacent to the stipulated acceptable entry condition.

(3) *Duration of testing.* Measurement of values for each atmospheric parameter should be made for at least the minimum response time of the test instrument specified by the manufacturer.

(4) *Testing stratified atmospheres.* When monitoring for entries involving a descent into atmospheres that may be stratified, the atmospheric envelope should be tested a distance of approximately 4 feet (1.22 m) in the direction of travel and to each side. If a sampling probe is used, the entrant's rate of progress should be slowed to accommodate the sampling speed and detector response.

(5) *Order of testing.* A test for oxygen is performed first because most combustible gas meters are oxygen dependent and will not provide reliable readings in an oxygen deficient atmosphere. Combustible gases are tested for next because the threat of fire or explosion is both more immediate and more life threatening, in most cases, than exposure to toxic gases and vapors. If tests for toxic gases and vapors are necessary, they are performed last.

[58 FR 4549, Jan. 14, 1993; 58 FR 34846, June 29, 1993]

**1910.146 App C - Examples of Permit-required Confined Space Programs**
STANDARD NUMBER:
1910.146 App C
STANDARD TITLE : Examples of Permit-required Confined Space Programs
SUBPART NUMBER : J
SUBPART TITLE: General Environmental Controls
TEXT :

Example 1.

*Workplace.* Sewer entry.

*Potential hazards.* The employees could be exposed to the following: Engulfment.

*Presence of toxic gases.* Equal to or more than 10 ppm hydrogen sulfide measured as an 8-hour time-weighted average. If the presence of other toxic contaminants is suspected, specific monitoring programs will be developed.

*Presence of explosive/flammable gases.* Equal to or greater than 10% of the lower flammable limit (LFL).

*Oxygen Deficiency.* A concentration of oxygen in the atmosphere equal to or less than 19.5% by volume.

A. ENTRY WITHOUT PERMIT/ ATTENDANT

*Certification.* Confined spaces may be entered without the need for a written permit or attendant provided that the space can be maintained in a safe condition for entry by mechanical ventilation alone, as provided in 1910.146(c)(5). All spaces shall be considered permit-required confined spaces until the pre-entry procedures demonstrate otherwise. Any employee required or permitted to pre-check or enter an enclosed/confined space shall have successfully completed, as a minimum, the training as required by the following sections of these procedures. A written copy of operating and rescue procedures as required by these procedures shall be at the work site for the duration of the job. The Confined Space Pre-Entry Check List must be completed by the LEAD WORKER before entry into a confined space. This list verifies completion of items listed below. This check list shall be kept at the job site for duration of the job. If circumstances dictate an interruption in the work, the permit space must be re-evaluated and a new check list must be completed.

*Control of atmospheric and engulfment hazards.*

*Pumps and Lines.* All pumps and lines which may reasonably cause contaminants to flow into the space shall be disconnected, blinded and locked out, or effectively isolated by other means to prevent development of dangerous air contamination or engulfment. Not all laterals to sewers or storm drains require blocking. However, where experience or knowledge of industrial use indicates there is a reasonable potential for contamination of air or engulfment into an occupied sewer, then all affected laterals shall be blocked. If blocking and/or isolation requires entry into the space the provisions for entry into a permit-required confined space must be implemented.

*Surveillance.* The surrounding area shall be surveyed to avoid hazards such as drifting vapors from the tanks, piping, or sewers.

*Testing.* The atmosphere within the space will be tested to determine whether dangerous air contamination and/or oxygen deficiency exists. Detector tubes, alarm only gas monitors and explosion meters are examples of monitoring equipment that may be used to test permit space atmospheres. Testing shall be performed by the LEAD WORKER who has successfully completed the Gas Detector training for the monitor he will use. The minimum parameters to be monitored are oxygen deficiency, LFL, and hydrogen sulfide concentration. A written record of the pre-entry test results shall be made and kept at the work site for the duration of the job. The supervisor will certify in writing, based upon the results of the pre-entry testing, that all hazards have been eliminated. Affected employees shall be able to review the testing results. The most hazardous conditions shall govern when work is being performed in two adjoining, connecting spaces.

*Entry Procedures.* If there are no non-atmospheric hazards present and if the pre-entry tests show there is no dangerous air contamination and/or oxygen deficiency within the space and there is no reason to believe that any is likely to develop, entry into and work within may proceed. Continuous testing

of the atmosphere in the immediate vicinity of the workers within the space shall be accomplished. The workers will immediately leave the permit space when any of the gas monitor alarm set points are reached as defined. Workers will not return to the area until a SUPERVISOR who has completed the gas detector training has used a direct reading gas detector to evaluate the situation and has determined that it is safe to enter.

*Rescue.* Arrangements for rescue services are not required where there is no attendant. See the rescue portion of section B., below, for instructions regarding rescue planning where an entry permit is required.

B. ENTRY PERMIT REQUIRED

*Permits.* Confined Space Entry Permit. All spaces shall be considered permit-required confined spaces until the pre-entry procedures demonstrate otherwise. Any employee required or permitted to pre-check or enter a permit-required confined space shall have successfully completed, as a minimum, the training as required by the following sections of these procedures. A written copy of operating and rescue procedures as required by these procedures shall be at the work site for the duration of the job. The Confined Space Entry Permit must be completed before approval can be given to enter a permit-required confined space. This permit verifies completion of items listed below. This permit shall be kept at the job site for the duration of the job. If circumstances cause an interruption in the work or a change in the alarm conditions for which entry was approved, a new Confined Space Entry Permit must be completed.

*Control of atmospheric and engulfment hazards.*

*Surveillance.* The surrounding area shall be surveyed to avoid hazards such as drifting vapors from tanks, piping or sewers.

*Testing.* The confined space atmosphere shall be tested to determine whether dangerous air contamination and/or oxygen deficiency exists. A direct reading gas monitor shall be used. Testing shall be performed by the SUPERVISOR who has successfully completed the gas detector training for the monitor he will use. The minimum parameters to be monitored are oxygen deficiency, LFL and hydrogen sulfide concentration. A written record of the pre-entry test results shall be made and kept at the work site for the duration of the job. Affected employees shall be able to review the testing results. The most hazardous conditions shall govern when work is being performed in two adjoining, connected spaces.

*Space Ventilation.* Mechanical ventilation systems, where applicable, shall be set at 100% outside air. Where possible, open additional manholes to increase air circulation. Use portable blowers to augment natural circulation if needed. After a suitable ventilating period, repeat the testing. Entry may not begin until testing has demonstrated that the hazardous atmosphere has been eliminated.

*Entry Procedures.* The following procedure shall be observed under any of the following conditions: 1.) Testing demonstrates the existence of dangerous or deficient conditions and additional ventilation cannot reduce concentrations to safe levels; 2.) The atmosphere tests as safe but unsafe conditions can reasonably be expected to develop; 3.) It is not feasible to provide for ready exit from spaces equipped with automatic fire suppression systems and it is not practical or safe to deactivate such systems; or 4.) An emergency exists and it is not feasible to wait for pre-entry procedures to take effect. All personnel must be trained. A self contained breathing apparatus shall be worn by any person entering the space. At least one worker shall stand by the outside of the space ready to give assistance in case of emergency. The standby worker shall have a self contained breathing apparatus available for immediate use. There shall be at least one additional worker within sight or call of the standby worker. Continuous powered communications shall be maintained between the worker within theconfined space and standby personnel. If at any time there is any questionable action or non-movement by the worker inside, a verbal check will be made. If there is no response, the worker will be moved immediately. Exception: If the worker is disabled due to falling or impact, he/she shall not be removed from the confined space unless there is immediate danger to his/her life. Local fire department rescue personnel shall be notified immediately. The standby worker may only enter the confined space in case of an emergency (wearing the self contained breathing apparatus) and only after being relieved by another worker. Safety belt or harness with attached lifeline shall be used by all workers entering the space with the free end of the line secured outside the entry opening. The standby worker shall attempt to remove a disabled worker via his lifeline before entering the space. When practical, these spaces shall be entered through side openings — those within 3 1/2 feet (1.07 m) of the bottom. When entry must be through a top opening, the safety belt shall be of the harness type that suspends a person upright and a hoisting device or similar apparatus shall be available for lifting workers out of the space. In any situation where their use may endanger the worker, use of a hoisting device or safety belt and attached lifeline may be discontinued. When dangerous air contamination is attributable to flammable and/or explosive substances, lighting and electrical equipment shall be Class 1, Division 1 rated per National Electrical Code and no ignition sources shall be introduced into the area. Continuous gas monitoring shall be performed during all confined space operations. If alarm conditions change adversely, entry personnel shall exit the confined space and a new confined space permit issued.

*Rescue.* Call the fire department services for rescue. Where immediate hazards to injured personnel are present, workers at the site shall implement emergency procedures to fit the situation.

Example 2.

*Workplace.* Meat and poultry rendering plants.

Cookers and dryers are either batch or continuous in their operation. Multiple batch cookers are operated in parallel. When one unit of a multiple set is shut down for repairs, means are available to isolate that unit from the others which remain in operation. Cookers and dryers are horizontal, cylindrical vessels equipped with a center, rotating shaft and agitator paddles or discs. If the inner shell is jacketed, it is usually heated with steam at pressures up to 150 psig (1034.25 kPa). The rotating shaft assembly of the continuous cooker or dryer is also steam heated.

*Potential Hazards.* The recognized hazards associated with cookers and dryers are the risk that employees could be:

1. Struck or caught by rotating agitator;
2. Engulfed in raw material or hot, recycled fat;
3. Burned by steam from leaks into the cooker/dryer steam jacket or the condenser duct system if steam valves are not properly closed and locked out;
4. Burned by contact with hot metal surfaces, such as the agitator shaft assembly, or inner shell of the cooker/dryer;
5. Heat stress caused by warm atmosphere inside cooker/dryer;

6. Slipping and falling on grease in the cooker/dryer;

7. Electrically shocked by faulty equipment taken into the cooker/dryer;

8. Burned or overcome by fire or products of combustion; or

9. Overcome by fumes generated by welding or cutting done on grease covered surfaces.

*Permits.* The supervisor in this case is always present at the cooker/dryer or other permit entry confined space when entry is made. The supervisor must follow the pre-entry isolation procedures described in the entry permit in preparing for entry, and ensure that the protective clothing, ventilating equipment and any other equipment required by the permit are at the entry site.

*Control of hazards.* Mechanical. Lock out main power switch to agitator motor at main power panel. Affix tag to the lock to inform others that a permit entry confined space entry is in progress.

*Engulfment.* Close all valves in the raw material blow line. Secure each valve in its closed position using chain and lock. Attach a tag to the valve and chain warning that a permit entry confined space entry is in progress. The same procedure shall be used for securing the fat recycle valve.

*Burns and heat stress.* Close steam supply valves to jacket and secure with chains and tags. Insert solid blank at flange in cooker vent line to condenser manifold duct system. Vent cooker/dryer by opening access door at discharge end and top center door to allow natural ventilation throughout the entry. If faster cooling is needed, use an portable ventilation fan to increase ventilation. Cooling water may be circulated through the jacket to reduce both outer and inner surface temperatures of cooker/dryers faster. Check air and inner surface temperatures in cooker/dryer to assure they are within acceptable limits before entering, or use proper protective clothing.

*Fire and fume hazards.* Careful site preparation, such as cleaning the area within 4 inches (10.16 cm) of all welding or torch cutting operations, and proper ventilation are the preferred controls. All welding and cutting operations shall be done in accordance with the requirements of 29 CFR Part 1910, Subpart Q, OSHA's welding standard. Proper ventilation may be achieved by local exhaust ventilation, or the use of portable ventilation fans, or a combination of the two practices.

*Electrical shock.* Electrical equipment used in cooker/dryers shall be in serviceable condition.

*Slips and falls.* Remove residual grease before entering cooker/dryer.

*Attendant.* The supervisor shall be the attendant for employees entering cooker/dryers.

*Permit.* The permit shall specify how isolation shall be done and any other preparations needed before making entry. This is especially important in parallel arrangements of cooker/dryers so that the entire operation need not be shut down to allow safe entry into one unit.

*Rescue.* When necessary, the attendant shall call the fire department as previously arranged.

Example 3.

*Workplace.* Workplaces where tank cars, trucks, and trailers, dry bulk tanks and trailers, railroad tank cars, and similar portable tanks are fabricated or serviced.

A. *During fabrication.* These tanks and dry-bulk carriers are entered repeatedly throughout the fabrication process. These products are not configured identically, but the manufacturing processes by which they are made are very similar.

*Sources of hazards.* In addition to the mechanical hazards arising from the risks that an entrant would be injured due to contact with components of the tank or the tools being used, there is also the risk that a worker could be injured by breathing fumes from welding materials or mists or vapors from materials used to coat the tank interior. In addition, many of these vapors and mists are flammable, so the failure to properly ventilate a tank could lead to a fire or explosion.

*Control of hazards.*

*Welding.* Local exhaust ventilation shall be used to remove welding fumes once the tank or carrier is completed to the point that workers may enter and exit only through a manhole. (Follow the requirements of 29 CFR 1910, Subpart Q, OSHA's welding standard, at all times.) Welding gas tanks may never be brought into a tank or carrier that is a permit entry confined space.

*Application of interior coatings/linings.* Atmospheric hazards shall be controlled by forced air ventilation sufficient to keep the atmospheric concentration of flammable materials below 10% of the lower flammable limit (LFL) (or lower explosive limit (LEL), whichever term is used locally). The appropriate respirators are provided and shall be used in addition to providing forced ventilation if the forced ventilation does not maintain acceptable respiratory conditions.

*Permits.* Because of the repetitive nature of the entries in these operations, an "Area Entry Permit" will be issued for a 1 month period to cover those production areas where tanks are fabricated to the point that entry and exit are made using manholes.

*Authorization.* Only the area supervisor may authorize an employee to enter a tank within the permit area. The area supervisor must determine that conditions in the tank trailer, dry bulk trailer or truck, etc. meet permit requirements before authorizing entry.

*Attendant.* The area supervisor shall designate an employee to maintain communication by employer specified means with employees working in tanks to ensure their safety. The attendant may not enter any permit entry confined space to rescue an entrant or for any other reason, unless authorized by the rescue procedure and, even then, only after calling the rescue team and being relieved by an attendant or another worker. *Communications and observation.* Communications between attendant and entrant(s) shall be maintained throughout entry. Methods of communication that may be specified by the permit include voice, voice powered radio, tapping or rapping codes on tank walls, signalling tugs on a rope, and the attendant's observation that work activities such as chipping, grinding, welding, spraying, etc., which require deliberate operator control continue normally. These activities often generate so much noise that the necessary hearing protection makes communication by voice difficult.

*Rescue procedures.* Acceptable rescue procedures include entry by a team of employee-rescuers, use of public emergency services, and procedures for breaching the tank. The area permit specifies which procedures are available, but the area supervisor makes the final decision based on circumstances. (Certain injuries may make it necessary to breach the tank to remove a person rather than risk additional injury by removal through an existing manhole. However, the supervisor must ensure that no breaching procedure used for rescue would violate terms of the entry permit. For instance, if the tank must be breached by cutting with a torch, the tank surfaces to be cut must be free of volatile or combustible coatings within 4 inches (10.16 cm) of the cutting line and the atmosphere within the tank must be below the LFL.

*Retrieval line and harnesses.* The retrieval lines and harnesses generally required under this standard are usually

impractical for use in tanks because the internal configuration of the tanks and their interior baffles and other structures would prevent rescuers from hauling out injured entrants. However, unless the rescue procedure calls for breaching the tank for rescue, the rescue team shall be trained in the use of retrieval lines and harnesses for removing injured employees through manholes.

B. *Repair or service of "used" tanks and bulk trailers.*

*Sources of hazards.* In addition to facing the potential hazards encountered in fabrication or manufacturing, tanks or trailers which have been in service may contain residues of dangerous materials, whether left over from the transportation of hazardous cargoes or generated by chemical or bacterial action on residues of non-hazardous cargoes.

*Control of atmospheric hazards.* A "used" tank shall be brought into areas where tank entry is authorized only after the tank has been emptied, cleansed (without employee entry) of any residues, and purged of any potential atmospheric hazards.

*Welding.* In addition to tank cleaning for control of atmospheric hazards, coating and surface materials shall be removed 4 inches (10.16 cm) or more from any surface area where welding or other torch work will be done and care taken that the atmosphere within the tank remains well below the LFL. (Follow the requirements of 29 CFR 1910, Subpart Q, OSHA's welding standard, at all times.)

*Permits.* An entry permit valid for up to 1 year shall be issued prior to authorization of entry into used tank trailers, dry bulk trailers or trucks. In addition to the pre-entry cleaning requirement, this permit shall require the employee safeguards specified for new tank fabrication or construction permit areas.

*Authorization.* Only the area supervisor may authorize an employee to enter a tank trailer, dry bulk trailer or truck within the permit area. The area supervisor must determine that the entry permit requirements have been met before authorizing entry.

# Confined Space Pre-entry Checklist

See Safety Procedure.
A confined space is entered through an opening other than a door (such as a manhole or a side port) or requires the use of a ladder or rungs to reach the working level. Testing should be done to determine whether atmospheric concentrations are satisfactory. This checklist must be filled out whenever the job site meets these criteria.

| | Yes | No |
|---|---|---|
| 1. Does your survey of the surrounding area show it to be free of hazards such as drifting vapors from tanks, piping, or sewers? | ( ) | ( ) |
| 2. Does your knowledge of industrial or other discharges indicate that this area is likely to remain free of dangerous air contaminants while occupied? | ( ) | ( ) |
| 3. Are you certified in the operation of the gas monitor to be used? | ( ) | ( ) |
| 4. Has a gas monitor functional test (Bump Test) been performed during this shift on the gas monitor to be used? | ( ) | ( ) |
| 5. Did you test the atmosphere of the confined space prior to entry? | ( ) | ( ) |
| 6. Did the atmosphere check as acceptable (no alarms given)? | ( ) | ( ) |
| 7. Will the atmosphere be continuously monitored while the space is occupied? | ( ) | ( ) |
| Contact County Centrex for personnel rescue by the local fire department in the event of an emergency. If onsite at the Regional Treatment Plant, contact the Plant Control Center (PCC). | ( ) | ( ) |

Notice: If any of the above questions are answered "no," do not enter. Contact your immediate supervisor.

Job Location _____

Lead Person Signature _____ Date _____

# CONFINED SPACE ENTRY PERMIT
## (Pre-entry/Entry Checklist)

Date and time issued: _____
Job site: _____
Equipment to be worked on: _____

Pre-entry (see Safety Procedure)

1. Atmospheric checks:

| | | |
|---|---|---|
| Time | _____ | |
| Oxygen | _____ | % |
| Explosive | _____ | % LFL |
| Toxic | _____ | ppm |

2. Source isolation (no entry):

| | N/A | Yes | No |
|---|---|---|---|
| Pumps or lines blinded, disconnected, or blocked | ( ) | ( ) | ( ) |

3. Ventilation modification:

| | N/A | Yes | No |
|---|---|---|---|
| Mechanical | ( ) | ( ) | ( ) |
| Natural ventilation only | ( ) | ( ) | ( ) |

4. Atmospheric check after isolation and ventilation:

| | | | |
|---|---|---|---|
| Oxygen _____ | % | > | 19.5% |
| Explosive _____ | % LFL | < | 10% |
| Toxic _____ | ppm | < | 10 ppm $H_2S$ |
| Time _____ | | | |

If conditions are in compliance with the above requirements and there is no reason to believe conditions may change adversely, then proceed to the Permit Space Pre-entry Checklist. Complete and post with this permit. If conditions are not in compliance with the above requirements or there is reason to believe that conditions may change adversely, proceed to the Entry Checklist portion of this permit.

Date and time expires: _____
Job supervisor: _____
Work to be performed: _____
Entry (see Safety Procedure): _____

1. Entry, standby, and backup persons:

| | Yes | No |
|---|---|---|
| Successfully completed required training? | ( ) | ( ) |
| Is it current? | ( ) | ( ) |

2. Equipment:

| | N/A | Yes | No |
|---|---|---|---|
| Direct-reading gas monitor-tested | ( ) | ( ) | ( ) |
| Safety harness and lifelines for entry and standby persons | ( ) | ( ) | ( ) |
| Hoisting equipment | ( ) | ( ) | ( ) |
| Powered communications | ( ) | ( ) | ( ) |
| SCBAs for entry and standby persons | ( ) | ( ) | ( ) |
| Protective clothing | ( ) | ( ) | ( ) |
| All electric equipment listed Class I, Division I, Group D and nonsparking tools | ( ) | ( ) | ( ) |

3. Rescue procedure:

_____
_____
_____
_____
_____
_____

We have reviewed the work authorized by this permit and the information contained herein. Written instructions and safety procedures have been received and are understood. Entry cannot be approved if any squares are marked in the "No" column. This permit is not valid unless all appropriate items are completed.

Permit and checklist prepared by (Supervisor): _____
Approved by (Unit Supervisor): _____
Reviewed by (confined space operations personnel): (printed name and signature)

_____ _____

This permit is to be kept at job site. Return job site copy to Safety Office following job completion.
Copies: White original (Safety Office) Yellow (Unit Supervisor) Hard (Job Site)

# ENTRY PERMIT

_____ CONFINED SPACE _____ HAZARDOUS AREA

**PERMIT VALID FOR 8 HOURS ONLY. ALL COPIES OF PERMIT WILL REMAIN AT JOB SITE UNTIL JOB IS COMPLETED.**

SITE LOCATION and DESCRIPTION _____

PURPOSE OF ENTRY _____

SUPERVISOR(S) in charge of crews Type of Crew Phone #

_____

*** BOLD DENOTES MINIMUM REQUIREMENTS TO BE COMPLETED AND REVIEWED PRIOR TO ENTRY ***

| REQUIREMENTS COMPLETED | DATE | TIME | REQUIREMENTS COMPLETED | DATE | TIME |
|---|---|---|---|---|---|
| **Lock Out/De-energize/Try-out** | | | **Full Body Harness w/"D" ring** | | |
| **Line(s) Broken-Capped-Blanked** | | | **Emergency Escape Retrieval Equip** | | |
| **Purge-Flush and Vent** | | | **Lifelines** | | |
| **Ventilation** | | | Fire Extinguishers | | |
| **Secure Area (Post and Flag)** | | | Lighting (Explosive Proof) | | |
| **Breathing Apparatus** | | | Protective Clothing | | |
| **Resuscitator - Inhalator** | | | Respirator(s) (Air Purifying) | | |
| **Standby Safety Personnel** | | | Burning and Welding Permit | | |

Note: Items that do not apply enter N/A in the blank.

****RECORD CONTINUOUS MONITORING RESULTS EVERY 2 HOURS**

| CONTINUOUS MONITORING** TEST(S) TO BE TAKEN | Permissible Entry Level | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PERCENT OF OXYGEN** | **19.5% TO 23.5%** | | | | | | | |
| **LOWER FLAMMABLE LIMIT** | **Under 10%** | | | | | | | |
| **CARBON MONOXIDE** | **+35 PPM** | | | | | | | |
| Aromatic Hydrocarbon | + 1 PPM | * 5PPM | | | | | | |
| Hydrogen Cyanide | (Skin) | * 4PPM | | | | | | |
| Hydrogen Sulfide | +10 PPM | * 15PPM | | | | | | |
| Sulfur Dioxide | + 2 PPM | * 5PPM | | | | | | |
| Ammonia | | * 35PPM | | | | | | |

* Short-term exposure limit: Employee can work in the area up to 15 minutes.

\+ 8 hr. Time Weighted Avg.: Employee can work in area 8 hrs. (longer with appropriate respiratory protection).

REMARKS: _____

| GAS TESTER NAME AND CHECK # | INSTRUMENT(S) USED | MODEL &/OR TYPE | SERIAL &/OR UNIT # |
|---|---|---|---|
| | | | |
| | | | |

SAFETY STANDBY PERSON IS REQUIRED FOR ALL CONFINED SPACE WORK

| SAFETY STANDBY PERSON(S) | CHECK # | NAME OF SAFETY STANDBY PERSON(S) | CHECK # |
|---|---|---|---|
| | | | |
| | | | |

SUPERVISOR AUTHORIZING ENTRY

ALL ABOVE CONDITIONS SATISFIED _____

DEPARTMENT _____ Phone _____

AMBULANCE 2800
Safety 4901
Original to Department

FIRE 2900
Gas Coordinator 4529/5387
Pink Copy to Safety

1910.146 App E - Sewer System Entry.
STANDARD NUMBER:
1910.146 App E
STANDARD TITLE : Sewer System Entry.
SUBPART NUMBER : J
SUBPART TITLE: General Environmental Controls
TEXT :

Sewer entry differs in three vital respects from other permit entries; first, there rarely exists any way to completely isolate the space (a section of a continuous system) to be entered; second, because isolation is not complete, the atmosphere may suddenly and unpredictably become lethally hazardous (toxic, flammable or explosive) from causes beyond the control of the entrant or employer, and third, experienced sewer workers are especially knowledgeable in entry and work in their permit spaces because of their frequent entries. Unlike other employments where permit space entry is a rare and exceptional event, sewer workers' usual work environment is a permit space.

(1) *Adherence to procedure.* The employer should designate as entrants only employees who are thoroughly trained in the employer's sewer entry procedures and who demonstrate that they follow these entry procedures exactly as prescribed when performing sewer entries.

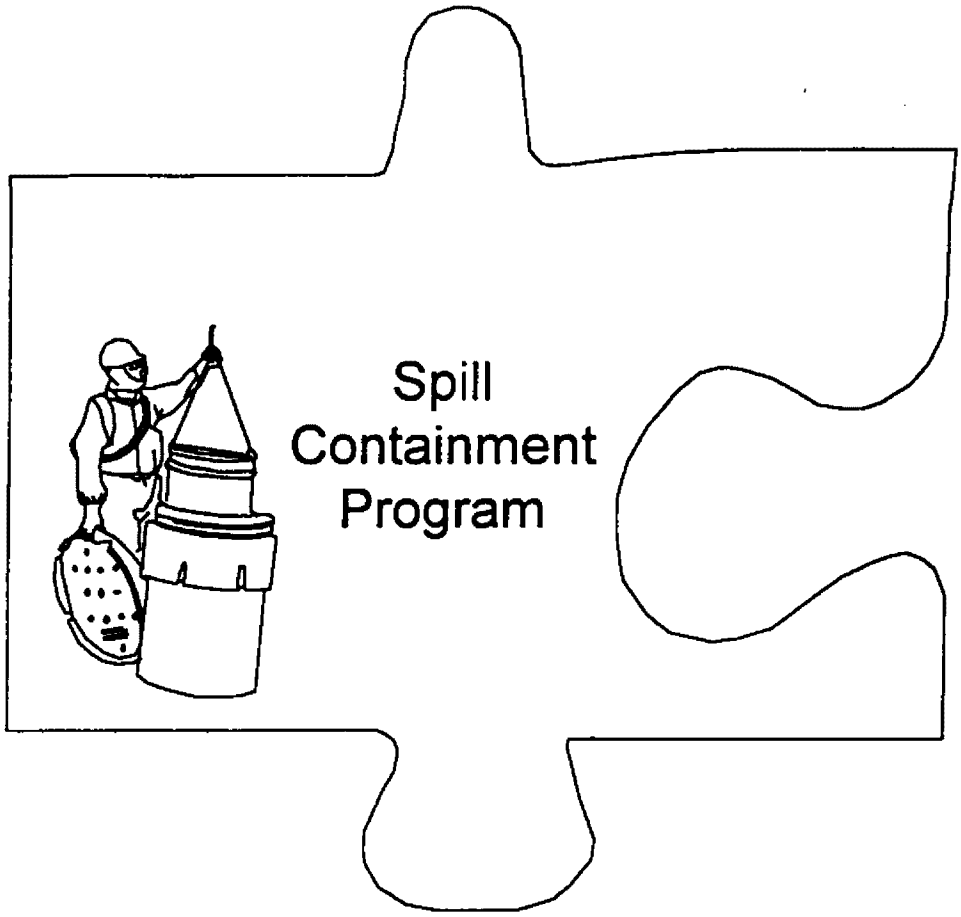
(2) *Atmospheric monitoring.* Entrants should be trained in the use of, and be equipped with, atmospheric monitoring equipment which sounds an audible alarm, in addition to its visual readout, whenever one of the following conditions are encountered: Oxygen concentration less than 19.5 percent; flammable gas or vapor at 10 percent or more of the lower flammable limit (LFL); or hydrogen sulfide or carbon monoxide at or above 10 ppm or 35 ppm, respectively, measured as an 8-hour time-weighted average. Atmospheric monitoring equipment needs to be calibrated according to the manufacturer's instructions. The oxygen sensor/broad range sensor is best suited for initial use in situations where the actual or potential contaminants have not been identified, because broad range sensors, unlike substance-specific sensors, enable employers to obtain an overall reading of the hydrocarbons (flammables) present in the space. However, such sensors only indicate that a hazardous threshold of a class of chemicals has been exceeded. They do not measure the levels of contamination of specific substances. Therefore, substance-specific devices, which measure the actual levels of specific substances, are best suited for use where actual and potential contaminants have been identified. The measurements obtained with substance-specific devices are of vital importance to the employer when decisions are made concerning the measures necessary to protect entrants (such as ventilation or personal protective equipment) and the setting and attainment of appropriate entry conditions. However, the sewer environment may suddenly and unpredictably change, and the substance-specific devices may not detect the potentially lethal atmospheric hazards which may enter the sewer environment. Although OSHA considers the information and guidance provided above to be appropriate and useful in most sewer entry situations, the Agency emphasizes that each employer must consider the unique circumstances, including the predictability of the atmosphere, of the sewer permit spaces in the employer's workplace in preparing for entry. Only the employer can decide, based upon his or her knowledge of, and experience with permit spaces in sewer systems, what the best type of testing instrument may be for any specific entry operation. The selected testing instrument should be carried and used by the entrant in sewer line work to monitor the atmosphere in the entrant's environment, and in advance of the entrant's direction of movement, to warn the entrant of any deterioration in atmospheric conditions. Where several entrants are working together in the same immediate location, one instrument, used by the lead entrant, is acceptable.

(3) *Surge flow and flooding.* Sewer crews should develop and maintain liaison, to the extent possible, with the local weather bureau and fire and emergency services in their area so that sewer work may be delayed or interrupted and entrants withdrawn whenever sewer lines might be suddenly flooded by rain or fire suppression activities, or whenever flammable or other hazardous materials are released into sewers during emergencies by industrial or transportation accidents.

(4) *Special Equipment.* Entry into large bore sewers may require the use of special equipment. Such equipment might include such items as atmosphere monitoring devices with automatic audible alarms, escape self-contained breathing apparatus (ESCBA) with at least 10 minute air supply (or other NIOSH approved self-rescuer), and waterproof flashlights, and may also include boats and rafts, radios and rope stand-offs for pulling around bends and corners as needed.

[58 FR 4549, Jan. 14, 1993; 58 FR 34845, June 29, 1993; 59 FR 26115, May 19, 1994]

# SPILL CONTAINMENT PROGRAM




TP-1

## *Module Goals:*

The student goals for this module are:

1. Given 29 CFR 1910.120(j), identify the general requirements of a spill containment program to be used on a hazardous waste site.

2. Given the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), the Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III, and excerpts from 40 CFR 302 and 355, identify spill reporting requirements for hazardous waste operations and emergency response.

Given 29 CFR 1910.120(j), identify the general requirements of a spill containment program to be used on a given waste site.

## Spill Containment Program Considerations

- Drum and _____ handling
- _____ of drums and containers
- Material handling _____
- _____ wastes
- _____-sensitive wastes
- Laboratory _____ packs
- _____ of drum or container contents
- _____ and transport of drums or containers
- Appropriate _____ for tank and vault entry

TP-2

Given 29 CFR 1910.120(j), describe the general requirements for container handling at waste sites to reduce the incidence of spills.

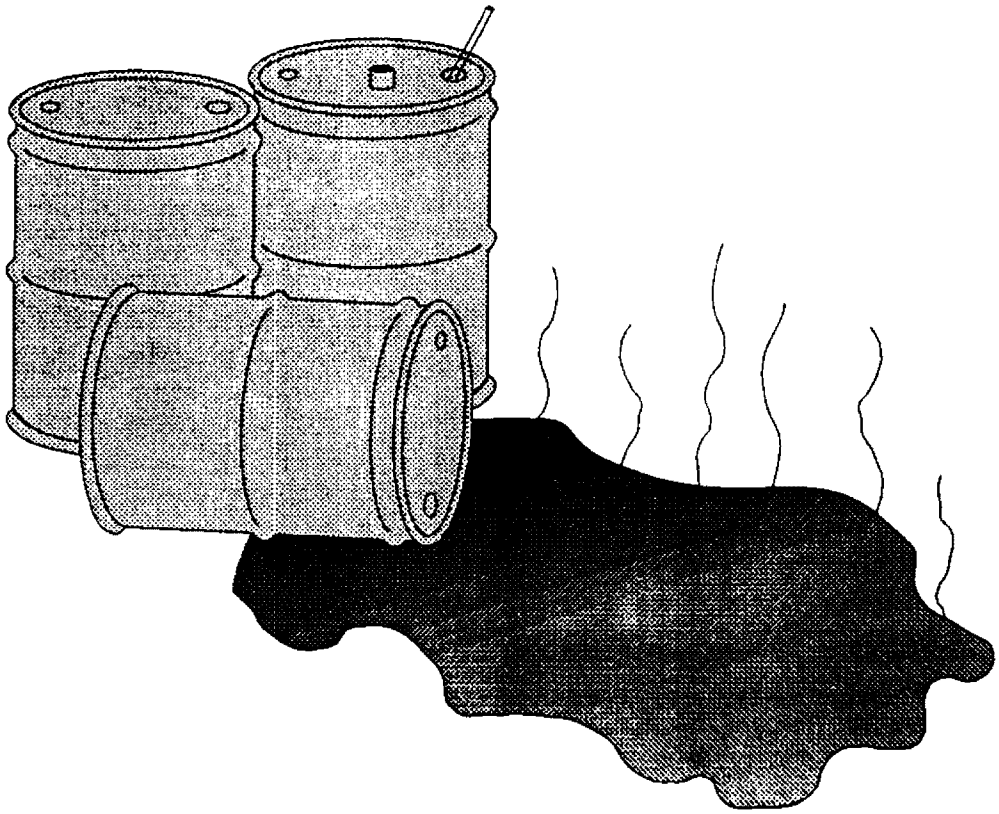
## Container Handling

- Use U.S. Department of Transportation (DOT) approved salvage drums
- Have adequate proper absorbents present where spills, leaks, or ruptures may occur
- If there is a major spill potential, a program should be in place to isolate and contain the entire volume of the hazardous substance being transferred

TP-3

Given CERCLA, SARA Title III, and excerpts from 40 CFR 302 and 355, identify spill reporting requirements for hazardous waste operations and emergency response.

# Reporting of Spills or Releases



TP-4

Given CERCLA Section 103, define a reportable spill of hazardous wastes or substances.

## Reportable Spill
## Section 103

_____of any hazardous substance in quantities equal to or greater than the reportable quantities (RQs) found in Section 102, CERCLA.

*Adapted from:* CERCLA Section 103

**TP-5**

Given CERCLA, SARA Title III, and excerpts from 40 CFR 302 and 355, list the requirements of reporting spilled hazardous wastes and substances.

## Spill Reporting Regulations

**SARA Title III**

Immediate notification of release to the Local Emergency Planning Committee (LEPC) and the State Emergency Response Commission (SERC):

- Extremely hazardous substances (EHSs) released equal to or greater than their RQs
- Codified 40 CFR 355 — Extremely Hazardous Substances

Immediate notification of release to LEPC, SERC and National Response Center (NRC):

- Hazardous substance released equal to or greater than its RQ
- Codified 40 CFR 302 — Hazardous Substances and Reportable Quantities

**CERCLA 103**

Immediate notification of release to NRC:

- Hazardous substance released equal to or greater than its RQ
- Codified 40 CFR 302 — Hazardous Substances and Reportable Quantities
- Some substances are found on both tables and are subject to notification of LEPC, SERC, and NRC

*Source:* 40 CFR 302.8, 40 CFR 355.40, and Title III Fact Sheet EPA 550-F-93-002 **TP-6**

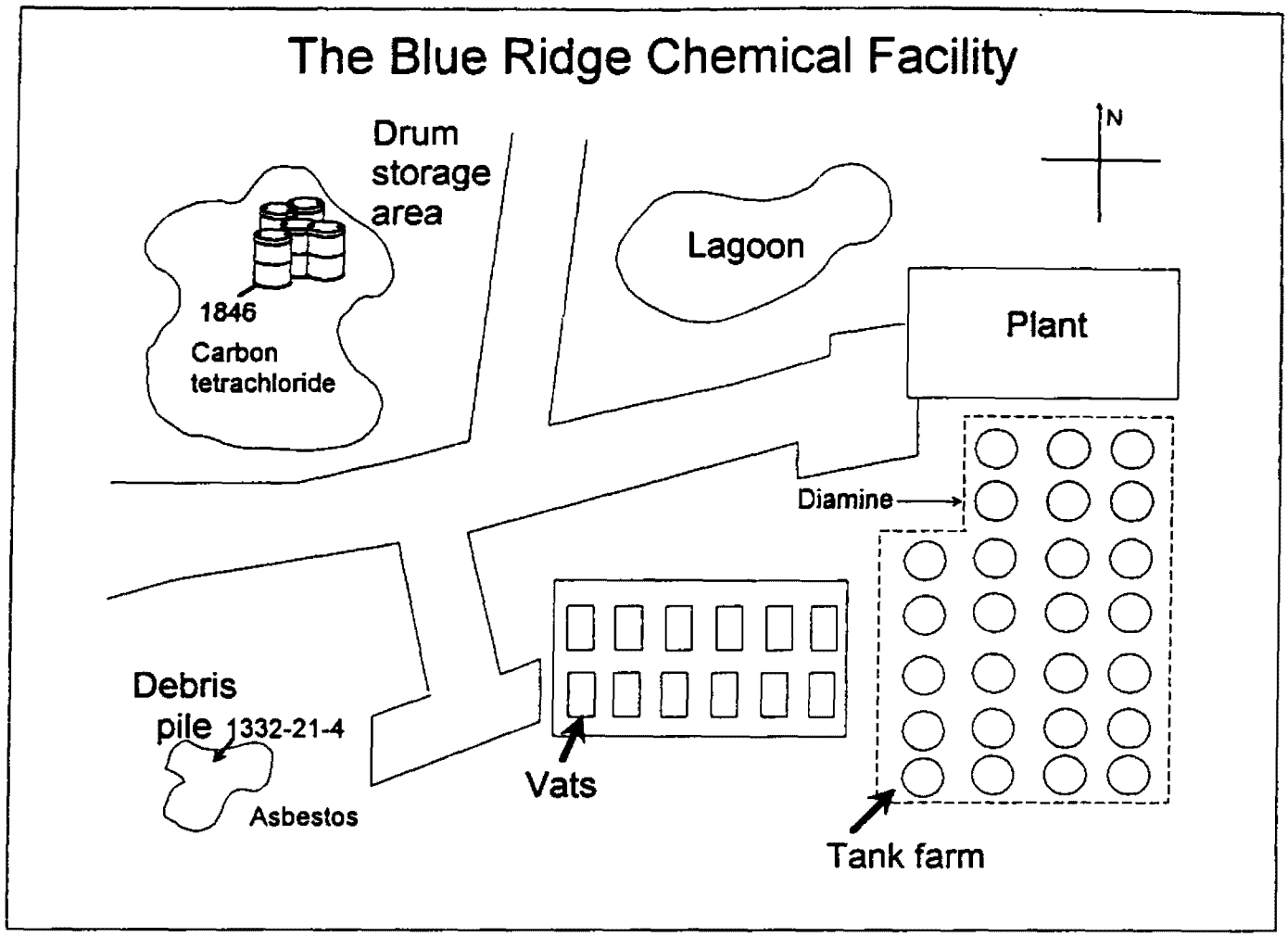
Given CERCLA 103 and SARA Title III:

- List the similarities between the reporting requirements of each.
- List the differences between the reporting requirements of each.

## Release Reporting

- 40 CFR 302.4 material released onsite, equal to or greater than RQ, leaves site boundaries:
  - CERCLA 103 — _____
  - SARA Title III — _____
- 40 CFR 355 material released onsite, equal to or greater than RQ, leaves site boundaries:
  - CERCLA 103 — _____
  - SARA Title III — _____
- Either 40 CFR 302.4 or 40 CFR 355 material released onsite, below RQ:
  - CERCLA 103 — _____
  - SARA Title III — _____

TP-7




## Site Data

| | |
|---|---|
| Temperature | 70°F |
| Humidity | 50% |
| Barometric Pressure | 29.92 S |
| Wind Speed | 10 mph |
| Wind Direction | NNE to SW |
| Skies | Sunny |

## Considerations for a Spill Containment Program

## Conclusion

- Confined Space Entry Program
- **Spill Containment Program**
- Emergency Response Plans

**TP-8**

### Crossword Puzzle

**Across**

29. A spill _____ program is a required part of a site-specific health and safety plan

**Down**

4. Spill _____ requirements for extremely hazardous substances can be found in SARA Title III, Section 304

# APPENDIX

## Summary of Notification Requirements Matrix

U.S. EPA Headquarters Library
Mail Code 3201
1200 Pennsylvania Avenue NW
Washington DC 20460

## SUMMARY OF NOTIFICATION REQUIREMENTS MATRIX

Several different regulations implement the CERCLA and CWA requirements that hazardous substance releases and oil discharges be reported to the NRC [33 CFR Parts 153.101, 153.203; 40 CFR Parts 110.10, 117.21, 300.125, 300.170, 300.300, 300.405, 302.6, 302.8]. Other federal reporting requirements include the following:

### REQUIREMENTS TO NOTIFY STATE AND LOCAL AUTHORITIES BASED ON STATUTORY PROVISIONS – A "one-call" system cannot be implemented by a rule change

- A release of a specific hazardous substance, such as cadmium metal, is reported to the Local Emergency Planning Committee (LEPC) and the State Emergency Response Commission (SERC) [29 CFR Parts 1915.1027, 1926.1127, 1928.1027, 1928; 40 CFR Part 355.40].

### REQUIREMENTS DEALING SPECIFICALLY WITH OIL OR HAZARDOUS SUBSTANCE SPILLS – Other Federal agencies may be notified in addition to the NRC

- Outer continental shelf oil spills are reported to the Department of Interior's Minerals Management Service (MMS) District Supervisor and the MMS Director [30 CFR Parts 250.42, 282.27];
- Suspected or actual releases of a hazardous substance or oil from an UST is reported to EPA or approved State UST Program [40 CFR Parts 280.40, 280.50, 280.53, 280.61, 280.110, 280.230];
- Oil spills on the Ohio River, the Mississippi River above Cairo, IL, and their tributaries are reported to the nearest lock downstream [33 CFR 207.300];
- Vessel or waterfront facility spills of oil or a hazardous substance are reported to the USCG and/or the Captain of the Port [33 CFR Parts 126.29, 127.321, 135.305, 151.15, 151.26, 151.45, 156.200, 158.167, 160.215; 30 CFR Part 250.42; 49 CFR Part 176.156]; and
- Breakage, spillage, or suspected radioactive contamination involving Class 7 materials shipments is reported to the Regional Office of DOE [49 CFR Part 175.700].

### REQUIREMENTS DEALING WITH RELEASES – Notification to the NRC may sometimes be required

- Permit violations (e.g., for the NPDES program) are reported to the regulatory authority [30 CFR Parts 715.17, 717.17, 817.41];
- Incidents involving air, rail, highway, or water transportation are reported to the Department of Transportation [40 CFR Parts 263.30, 279.43; 49 CFR Part 171.15];
- Incidents involving hazardous materials carried by aircraft are reported to the nearest FAA Civil Aviation Security Office [49 CFR Part 175.45]; and
- Incidents involving etiologic agents transported over land or by aircraft are reported to the Center for Disease Control (CDC) [49 CFR Parts 175.45, 171.15].

### REQUIREMENTS DEALING WITH ACCIDENTS THAT MAY INVOLVE A RELEASE

- General facility emergency situations are reported to the OSC [40 CFR Parts 264.56, 265.56]; and
- Work-related emergencies and incidents are reported to the OSHA Area Director [29 CFR Parts 1904.8, 1910.1003-1017, 1910.1045].

## REQUIREMENTS FOR OTHER NRC NOTIFICATION

- Generators of hazardous waste must report fires, explosions, or other releases, in addition to spills which have reached the surface water, to the NRC [40 CFR Parts 262.34, 307.22];
- The local government may inform the NRC within 24 hours of response in order to request reimbursement for their response efforts [40 CFR Part 310.30]; and
- Operators of pipeline systems must give notice of a release of hazardous liquid or carbon dioxide that is being transported and has resulted in an incident [49 CFR Part 195.52].

# Notification and Reporting Requirements for Oil and Hazardous Substances

| Regulation | Entity/Individual to Notify | Immediacy | Form of Notification | Description |
|---|---|---|---|---|
| **29 CFR – Occupational Safety & Health Administration Regulations** | | | | |
| 29 CFR Part 1904.8 | OSHA Area Director | within 8 hours | orally | Requires that an employer report any death of an employee or hospitalization of three or more employees resulting from a work-related incident. |
| 29 CFR Parts 1910.1003-1017 | OSHA Area Director | within 24 hours | not specified | Requires the reporting of incidents which result in the release of the specified carcinogen into any area where employees may potentially be exposed. |
| 29 CFR Part 1910.1045 | OSHA Area Director | within 72 hours | not specified | Requires the employer to report emergencies. |
| 29 CFR Part 1910.1048, Appendix A Part 1915.1048, Appendix A Part 1919.1048 Part 1926.1148, Appendix A | state and local authorities, if required, and if the spill is equal or greater than 1,000 lb/day, it is reportable under CERCLA | not specified | not specified | Requires that the employer comply with EPA rules regarding the cleanup of toxic waste and notify state and local authorities, if required, or the National Response Center (NRC) if it is a CERCLA hazardous substance and the spill is equal or greater than 1,000 lb/day. |
| 29 CFR Part 1915.1027, Appendix B Part 1926.1127, Appendix B Part 1928.1027, Subpart M Part 1928, Appendix B | Local Emergency Planning Committee (LEPC), state Emergency Response Commission (SERC), and NRC | immediately | telephone | Requires that a release equal to or greater than the reportable quantity (RQ) for the substance be reported in accordance with SARA. |

| Regulation | Entity/Individual to Notify | Immediacy | Form of Notification | Description |
|---|---|---|---|---|
| **30 CFR – Minerals Management Service Regulations** | | | | |
| 30 CFR Part 250.19 | District Supervisor | without delay if more than 1 barrel | orally | Requires the lessee to report all serious accidents, any death or serious injury, and all fires, explosions, and blowouts connected with any activities or operations on the lease. Spills of oil or other liquid pollutants shall be reported according to 250.41. |
| 30 CFR Part 250.41 | District Supervisor | without delay if more than 1 barrel | orally | Requires reporting of all spills of oil and liquid pollutants onto the surface of sea ice, and spills penetrating the surface of an artificial island. |
| 30 CFR Part 250.42 | MMS and USCG | timely | not specified | Requires that lessees report nonroutine hydrogen sulfide releases which result in an atmospheric concentration of 20 parts per million (ppm) and 50 ppm levels. The lessee is required to develop an Oil Spill Contingency Plan with procedures for notification of an oil spill. |
| 30 CFR Part 282.27 | Director | immediately | not specified | Requires that lessees notify the Director when there is a death or serious injury; fire, explosion, or other hazardous event which threatens damage to life, a mineral deposit, or equipment, spills of oil, chemical reagents, or other liquid pollutants which could cause pollution; or damage to aquatic life or the environment. |
| 30 CFR Part 715.17 Part 717.17 Part 817.41 | the regulatory authority | immediately | not specified | Requires reporting of noncompliance with the National Pollutant Discharge Elimination System (NPDES) permit conditions when analytical results of the samples collected indicate a violation. |
| 30 CFR Part 816.81 Part 817.81 | the regulatory authority | promptly | not specified | Requires reporting of a potential hazard concerning a coal mine waste disposal facility and of the emergency procedures formulated for public protection and remedial action (refers to coal mine waste). |

| Regulation | Entity/Individual to Notify | Immediacy | Form of Notification | Description |
|---|---|---|---|---|
| **33 CFR – United States Coast Guard Regulations** | | | | |
| 33 CFR Part 126.29 | Captain of the Port (COTP) or District Commander | immediately | not specified | Requires an owner/operator of the vessel or waterfront facility to report a discharge of petroleum by-products or other dangerous liquid commodities which may create a hazard or toxic condition in the port area of U.S. waters. |
| 33 CFR Part 127.321 Part 135.305 Part 151.15 Part 151.26 Part 151.45 Part 156.220 | NRC or COTP | immediately or as soon as the person has knowledge of the incident | telephone or radio | Requires reporting by the person in charge of a vessel or offshore facility that is involved in an incident, including occurrences which pose an imminent threat of oil or hazardous substance pollution. |
| 33 CFR Part 153.101 (procedures for notification) Part 153.203 | NRC, but if not practicable, then the USCG or the EPA on-scene coordinator (OSC) | immediately | not specified | Requires the person in charge to report any discharge of oil or a hazardous substance from a vessel or facility in violation of section 311(b)(3) of the Clean Water Act (CWA). |
| 33 CFR Part 158.167 | COTP | not specified | orally, in writing, or by telephone | states that any person may report that reception facilities required by MARPOL 73/78 are inadequate. |
| 33 CFR Part 160.215 | Coast Guard Marine Safety Office or group office | immediately | not specified | Requires that the owner, agent, master, operator, or person in charge to report when there is a hazardous condition either aboard a vessel or caused by a vessel or its operation. |
| 33 CFR Part 207.300 | Nearest lock downstream | not specified | not specified | Requires reporting of an oil spill on the Ohio River, Mississippi River above Cairo, IL, and their tributaries. |

| Regulation | Entity/Individual to Notify | Immediacy | Form of Notification | Description |
|---|---|---|---|---|
| **40 CFR – Environmental Protection Agency Regulations** | | | | |
| 40 CFR Part 63.311 | Administrator | within 24 hours of the beginning of the event | not specified | Requires that the owner or operator report any venting of coke oven gas through a bypass/ bleeder stack that was not vented through the bypass/bleeder stack flare system. |
| 40 CFR Part 110.10 | NRC, but if not practicable, the USCG or EPA OSC | immediately | telephone | Requires that any person in charge of a vessel or an onshore or offshore facility must report any discharge of oil. |
| 40 CFR Part 117.21 | appropriate agency of U.S. government | immediately | not specified | Requires that any person in charge of a vessel or an onshore or offshore facility must report any discharge of a designated hazardous substance in quantities equal to or exceeding in any 24-hour period the reportable quantity. References 33 CFR 153.203. |
| 40 CFR Part 122.41, Subpart C | State Director or EPA Regional Administrator | within 24 hours | orally | Requires that the permittee report any noncompliance with the NPDES permit which may endanger health or the environment. |
| 40 CFR Part 122.42 | State Director or EPA Regional Administrator | as soon as they have knowledge or reason to believe that an incident has or will occur | not specified | In addition to the reporting requirements under 40 CFR 122.41, all existing manufacturers, commercial, mining, and silvicultural dischargers must notify that any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed certain levels described in the regulation. |
| 40 CFR Part 141.31(a) | state | within 10 days | not specified | Requires that the supplier of water must report the results of any test measurement or analysis required by this part. |

| Regulation | Entity/Individual to Notify | Immediacy | Form of Notification | Description |
|---|---|---|---|---|
| **40 CFR – Environmental Protection Agency Regulations (cont.)** | | | | |
| 40 CFR Part 141.31(b) | state | within 48 hours | not specified | Requires that the supplier of water must report the failure to comply with any national primary drinking water regulation (including failure to comply with monitoring requirements) set forth in this part. |
| 40 CFR Part 240.204-3 | local regulatory agency | immediately | not specified | Recommends reporting any accidental spill during solid waste processing operations. |
| 40 CFR Part 241.211-3 | responsible agency | not specified | not specified | Recommends that any regular user who persistently poses a safety hazard by his driving be barred from the site and reported. |
| 40 CFR Part 258.23 | State Director | immediately | not specified | Requires that excessive methane gas levels as specified in paragraph (a) of this section be reported and all necessary steps to ensure protection of human health be taken. |
| 40 CFR Part 262.34 | NRC | immediately | telephone | Requires that the generator of hazardous waste report a fire, explosion, or other release which could threaten human health outside the facility or when the generator has knowledge that a spill has reached surface water. |
| 40 CFR Part 263.30, Subpart C | NRC if required by 49 CFR 171.15 or DOT if required by 49 CFR 171.16; local authorities | immediately | telephone | Requires that an air, rail, highway, or water transporter who has discharged hazardous waste must report the incident, if required by 49 CFR 171.15. |
| 40 CFR Part 264.56 Part 265.56 | NRC or OSC; also state or local agencies, if their help is needed | immediately | telephone | Requires the emergency coordinator to report whenever there is an imminent or actual emergency situation (i.e., release, fire, explosion which could threaten human health or the environment) involving a hazardous waste. |

| Regulation | Entity/Individual to Notify | Immediacy | Form of Notification | Description |
|---|---|---|---|---|
| **40 CFR – Environmental Protection Agency Regulations (cont.)** | | | | |
| 40 CFR Part 264.196 | EPA Regional Administrator or NRC if the release is equal to or greater than the RQ | within 24 hours | not specified | Requires that any release of a hazardous waste to the environment be reported, except if the release is less than or equal to one pound and is immediately contained and cleaned up, must be reported. |
| 40 CFR Part 265.196 | EPA Regional Administrator or NRC if the release is equal to or greater than the RQ | within 24 hours | not specified | Requires reporting of a leak or spill of hazardous waste that is greater than or equal to a quantity of one pound or the release of any reportable quantity to the Regional Administrator within 24 hours of detection or in accordance with 40 CFR 302. |
| 40 CFR Part 270.30, Subpart C | Director/EPA Regional Administrator | within 24 hours | orally | The permittee of hazardous waste facility shall report any noncompliance which may endanger health or the environment. |
| 40 CFR Part 271.11 Part 271.128 | state, local, and federal agencies | not specified | not specified | Requires the state to develop program requirements for transporters of hazardous waste so that they are required to notify the state, local and federal agencies of discharges, and clean up wastes, or take action so that the wastes do not present a hazard to human health or the environment. The reporting requirements must be equivalent to those found at 40 CFR 263.30 and 263.31. |
| 40 CFR Part 279.43 | NRC | immediately | not specified | In the event of a discharge of used oil during transportation, the transporter must take appropriate immediate action to protect human health and the environment (e.g., notify local authorities). An air, rail, highway, or water transporter who has discharged used oil must give notice, if required by 49 CFR 171.15 or 33 CFR 153.203. |

| Regulation | Entity/Individual to Notify | Immediacy | Form of Notification | Description |
|---|---|---|---|---|
| **40 CFR – Environmental Protection Agency Regulations (cont.)** | | | | |
| 40 CFR Part 279.52 | NRC and appropriate government OSC; state or local agencies if their help is needed | immediately | not specified | Requires the emergency coordinator to notify the appropriate persons whenever there is an imminent or actual emergency situation. |
| 40 CFR Part 280.40, Subpart D | implementing agency | not specified | not specified | When a release detection method indicates that a release from an underground storage tank may have occurred, owners or operators must notify the implementing agency in accordance with 40 CFR 280, Subpart E. |
| 40 CFR Part 280.50, Subpart E | implementing agency | within 24 hours or immediately if it is a release of a hazardous substance greater than or equal to the RQ | not specified | The owner or operator must report suspected releases from an underground storage tank within 24 hours. |
| 40 CFR Part 280.53 | implementing agency | within 24 hours or immediately if it is a release of a hazardous substance greater than or equal to the RQ | not specified | The owner or operator of an underground storage tank system must contain and immediately clean up a spill or overfill of petroleum that results in a release to the environment that exceeds 25 gallons or another reasonable amount, or that causes a sheen on nearby surface water, or, of a hazardous substance that results in a release to the environment that equals or exceeds its reportable quantity under CERCLA. |
| 40 CFR Part 280.61 | implementing agency | within 24 hours or immediately if it is a release of a hazardous substance greater than or equal to the RQ | telephone or electronic mail | Upon confirmation of a release from an underground storage tank (UST), owners or operators must notify the implementing agency. |
| 40 CFR Part 280.110 | Director of the implementing agency | within 30 days | not specified | Within 30 days after identifies of a release from an underground storage tank the owner or operator is required to report the release under 40 CFR 280.53 and 280.61. |

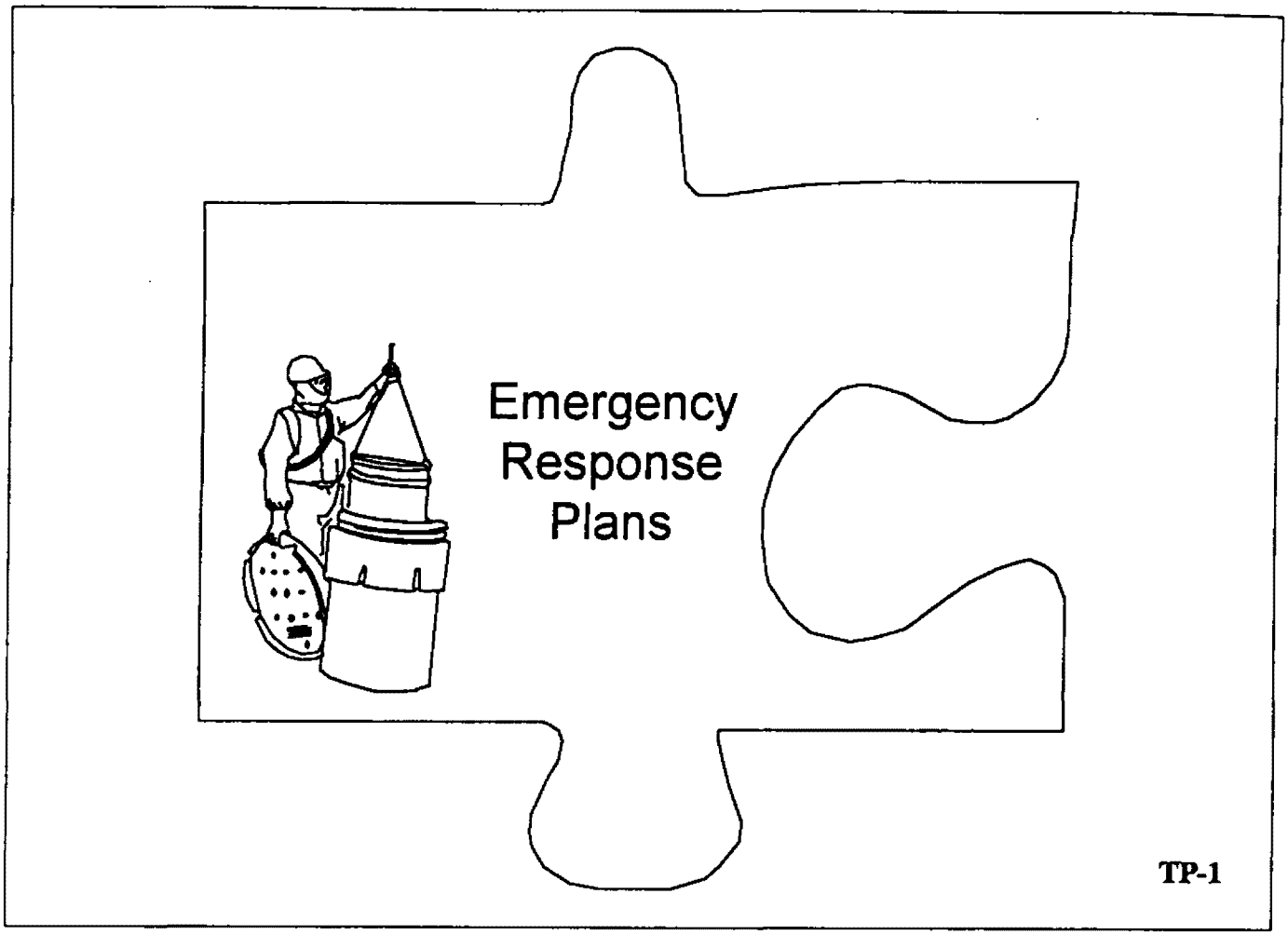
| Regulation | Entity/Individual to Notify | Immediacy | Form of Notification | Description |
|---|---|---|---|---|
| **40 CFR – Environmental Protection Agency Regulations (cont.)** | | | | |
| 40 CFR Part 280.230 | implementing agency | not specified | not specified | The owner or operator is required to report suspected releases from a UST system to the implementing agency. |
| 40 CFR Part 300.125 | NRC | immediately | telephone | Notice of an oil discharge or release of a hazardous substance in a amount equal to or greater than the reportable quantity must be made immediately in accordance with 33 CFR 153, Subpart B, and 40 CFR 302. |
| 40 CFR Part 300.170 | NRC | not specified | not specified | All federal agencies are responsible for reporting releases of hazardous substances, pollutants or contaminants, and discharges of oil from facilities or vessels under their jurisdiction or control in accordance with section 103 of CERCLA. |
| 40 CFR Part 300.300 Subpart D | NRC, but if not practicable, the USCG or EPA OSC | immediately | not specified | Any person in charge of a vessel or facility shall immediately notify the NRC of any discharge of a hazardous substance from the vessel or facility that is in violation of section 311(b)(3) of the CWA. |
| 40 CFR Part 300.320 | Regional Response Team and NRC | immediately | not specified | Requires the OSC to report when they receive a report of a discharge which is an actual or potential major discharge. |
| 40 CFR Part 300.405 | NRC, but if not practicable, the USCG or EPA OSC | promptly | not specified | Requires any person in charge of a vessel or facility to report releases in accordance with section 103(a) of CERCLA. |

| Regulation | Entity/Individual to Notify | Immediacy | Form of Notification | Description |
|---|---|---|---|---|
| **40 CFR – Environmental Protection Agency Regulations (cont.)** | | | | |
| 40 CFR Part 302.6 | NRC | immediately | not specified | Any person in charge of a vessel or an offshore or onshore facility shall, as soon as he has knowledge of any release of a hazardous substance from such vessel or facility in a quantity equal to or exceeding the reportable quantity in any 24-hour period, must immediately notify the NRC. |
| 40 CFR Part 302.8 | NRC | not specified | telephone | For continuous releases of a hazardous substance, the person in charge must make an initial telephone call and report the release to the NRC for a period sufficient to establish the continuity and stability of the release. |
| 40 CFR Part 307.22 | NRC | not specified | not specified | Requires the person to notify the NRC if there is acute threat of fire, explosion, or direct human contact with hazardous substances, pollutants, or contaminants or other emergency situation, to determine if there is sufficient time to submit an application for preauthorization. |
| 40 CFR Part 310.30 | NRC or EPA | within 24 hours of response | not specified | The local government must inform EPA or the NRC within 24 hours of response in order to request reimbursement for their response efforts. |
| 40 CFR Part 355.40 | community emergency coordinator for the LEPC and the SERC, or local response personnel | immediately | not specified | Requires the owner or operator to notify appropriate state officials if there is a discharge of a SARA extremely hazardous substance or a CERCLA hazardous substance. |
| 40 CFR Part 761.120 Part 761.125 | NRC for RQ release and EPA Regional Office for pesticides and toxic substances | immediately for RQ release and within 24 hours for other incidents | not specified | Releases of PCBs to surface water, drinking water supplies, sewers, grazing lands, etc., equal to or greater than 50 ppm concentration must be reported. Also for other releases that are equal to or greater than 10 pounds. |

| Regulation | Entity/Individual to Notify | Immediacy | Form of Notification | Description |
|---|---|---|---|---|
| **49 CFR – Department of Transportation Regulations** | | | | |
| 49 CFR Part 171.15 | DOT, NRC, or Center for Disease Control (CDC), as appropriate for incidents involving etiologic agents | earliest practicable moment | telephone | Each carrier who transports hazardous materials over land shall give notice after each incident that occurs during the course of transportation. Refers to 40 CFR 302.6 for additional reporting requirements. |
| 49 CFR Part 175.45 | nearest FAA Civil Aviation Security Office, or CDC, as appropriate for incidents involving etiologic agents | earliest practicable moment | telephone | Each operator who transports hazardous materials by aircraft must report after each incident that occurs during the course of transportation. The regulation lists the criteria for an incident, e.g., a person is killed, a person received injuries requiring his or her hospitalization, etc. |
| 49 CFR Part 175.700 | Regional Office of DOE or appropriate state or local radiological authorities; shipper of the materials | earliest practicable moment; before close of business the following day | not specified | In addition to the reporting requirements of 49 CFR 175.45, the carrier of the aircraft is required to notify the shipper following any incident in which there has been breakage, spillage, or suspected radioactive contamination involving Class 7 (radioactive) materials shipments. The Regional Office of DOE and appropriate state or local authorities should be notified in cases of obvious leakage. |
| 49 CFR Part 176.156 | COTP | as soon as practicable | not specified | If any Class 1 (explosive) materials are spilled or released from a package, the responsible person must ensure that appropriate emergency response is undertaken in accordance with 49 CFR 172.602. The master of the vessel must report each incident involving spillage or release of Class 1 materials. |
| 49 CFR Part 193.2011 | comply with 49 CFR 191 | comply with 49 CFR 191 | comply with 49 CFR 191 | Leaks and spills of LNG must be reported in accordance with the requirements of 49 CFR 191. |

| Regulation | Entity/Individual to Notify | Immediacy | Form of Notification | Description |
|---|---|---|---|---|
| **49 CFR – Department of Transportation Regulations (cont.)** | | | | |
| 49 CFR Part 195.52 | NRC | earliest practicable moment | telephone | The operator of a pipeline system is required to give notice of a release of hazardous liquid or carbon dioxide that is being transported and has resulted in an event described in 49 CFR 195.50. |

# EMERGENCY RESPONSE PLANS




## *Module Goals:*

The student goals for this module are:

1. Given 29 CFR 1910.120, 29 CFR 1910.38, the emergency action plan (EAP) regulation, and conditions on a hazardous waste site, identify the components necessary to complete an emergency response plan (ERP) to ensure worker protection at a hazardous waste site.

2. Given conditions on a hazardous waste site, identify the Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III planning requirements as they apply to hazardous waste operations and worker protection.

Given 29 CFR 1910.120, list the paragraphs that apply to emergency response planning.

## Emergency Response Planning

- Paragraph (l)

  Emergency Response by Employees at Uncontrolled Hazardous Waste Sites

- Paragraph (p)

  Certain Operations Conducted under the Resource Conservation and Recovery Act of 1976 (RCRA)

- Paragraph (q)

  Emergency Response to Hazardous Substance Releases

TP-2

Given 29 CFR 1910.38, list the required elements of an EAP.

## Definition of EAP

Designated _____ that employers and employees must take to ensure employee safety from fire and other emergencies at the work location.

*Source:* 29 CFR 1910.38(a) **TP-3**

# EAP Elements

1. Emergency _____ procedures and escape route assignments

2. _____ to be followed by employees who remain to operate critical plant operations before they evacuate

3. Procedures to _____ for all employees after emergency evacuation has been completed

4. Rescue and medical duties for those _____ who are to perform them

5. The preferred means of _____ fires and other emergencies

6. Names or regular job title of persons or departments who can be _____ for further information or explanation of duties under the plan

*Source:* 29 CFR 1910.38

**TP-4**

# Employee Alarm System

1. The alarm system shall provide _____ for necessary emergency action as called for in the EAP

2. The alarm system shall be perceived _____ ambient noise or light levels by all affected employees

3. The employee alarm shall be distinctive and _____ as a signal to evacuate or perform duties directed by the plan

4. The employer shall explain to each employee the preferred means of _____ emergencies, post emergency phone numbers near phones, and provide priority messages over site radios

5. With ten or fewer employees, _____ communications is an acceptable means of sounding an emergency

6. The employer shall ensure the use of _____ equipment, ensure proper maintenance and _____ of the system, maintain backup power supplies, and ensure that manually operated systems are _____

*Source:* 29 CFR 1910.165

**TP-5**

## Types of Evacuations

- ___, immediate evacuation of all employees in grave conditions
- Evacuation of _____ personnel followed by essential personnel as their emergency duties end
- _____ evacuations during area-specific emergencies

TP-6

## Training

The employer shall designate and train a sufficient number of _____ to assist in safe and orderly evacuations.

TP-7

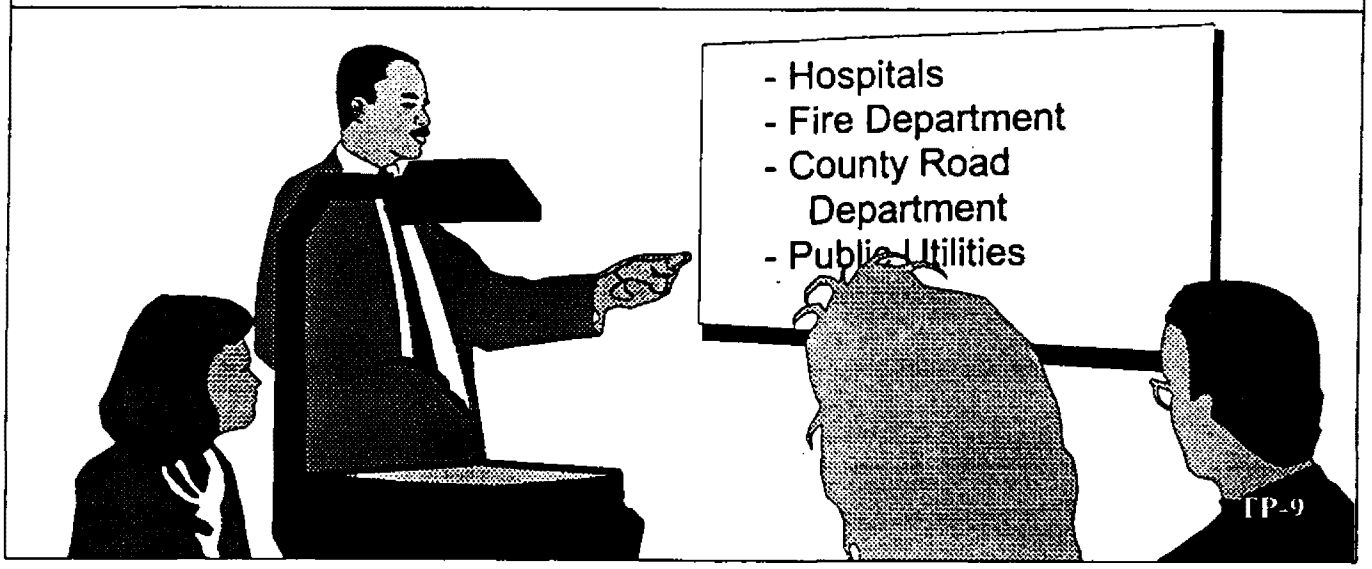
## EAP Review

- When the plan is first _____
- When the employee's _____ or designated actions under the plan change
- Whenever the plan is _____

TP-8

Given 29 CFR 1910.120(l), list the minimum elements of an ERP.

## Pre-emergency Planning

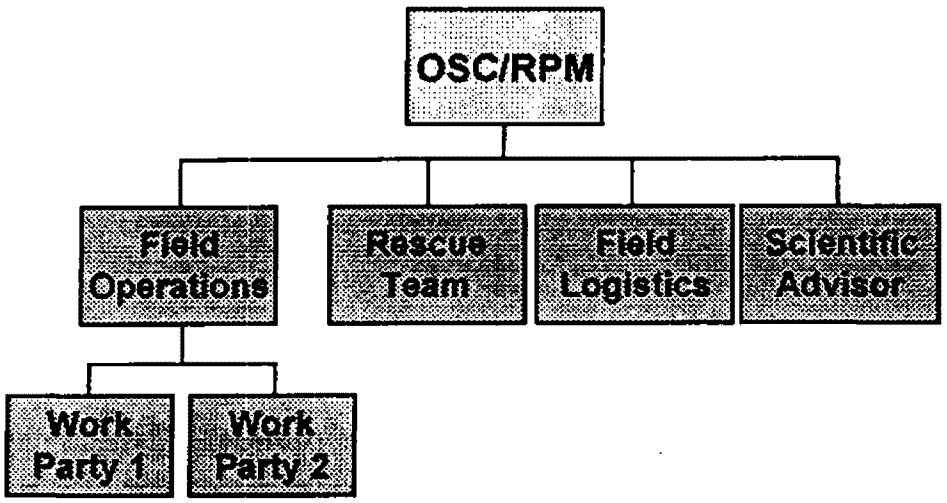



## Examples of Agencies and Groups Involved in Emergencies

| AGENCY OR GROUP | RESCUE | RESPONSE | SUPPORT |
|---|---|---|---|
| FEDERAL | | | |
| Army Corps of Engineers | | x | x |
| Coast Guard | | x | x |
| Department of Defense | | x | x |
| Department of Transportation | | x | x |
| Environmental Protection Agency (EPA) | | x | x |
| STATE | | | |
| Civil Defense | | x | x |
| Department of Health | | x | x |
| Department of Labor | | | x |
| Environmental Agency | | x | x |
| Office of the Attorney General | | | x |
| State Police | x | x | x |
| LOCAL | | | |
| Ambulance and rescue services | x | x | x |
| Cleanup contractor | x | x | x |
| Disposal companies | | x | x |
| Fire department | x | x | x |
| Hospital | | | x |
| Police | x | x | x |

*Source:* U.S. DHHS 1985

## Personnel Roles, Lines of Authority, Communications




TP-10

## *Personnel*

This component of the plan includes not only onsite and offsite personnel with specific emergency response roles, but also others who may be onsite, such as contractors, other agency representatives, and visitors.

Emergency personnel may be deployed in a variety of ways. Depending on the nature and scope of the emergency, the size of the site, and the number of personnel, the emergency response cadre can include individuals, small or large teams, or several interacting teams.

*In all cases the organizational structure should show a clear chain-of-command.* Every individual should know his or her position and authority, and the chain-of-command must be flexible enough to handle multiple emergencies, such as a rescue and spill response or two rescues with a fire and spill response.

**Project Team Leader**
- Directs emergency response operations

**Site Safety Officer**
- Oversees all aspects of safety at site

**Command Post Supervisor**
- Notifies outside contacts
- Assists site safety officer

**Rescue Team**
- Rescues endangered site workers

**Decontamination Team**
- Performs emergency decontamination

**24-Hour Medical Team**
- Transports and treats site victims

**Communication Personnel**
- Local emergency service networks provide links for mutual aid

**Environmental Scientists**
- Provide site predictions for chemical concentrations and onsite and offsite exposure levels

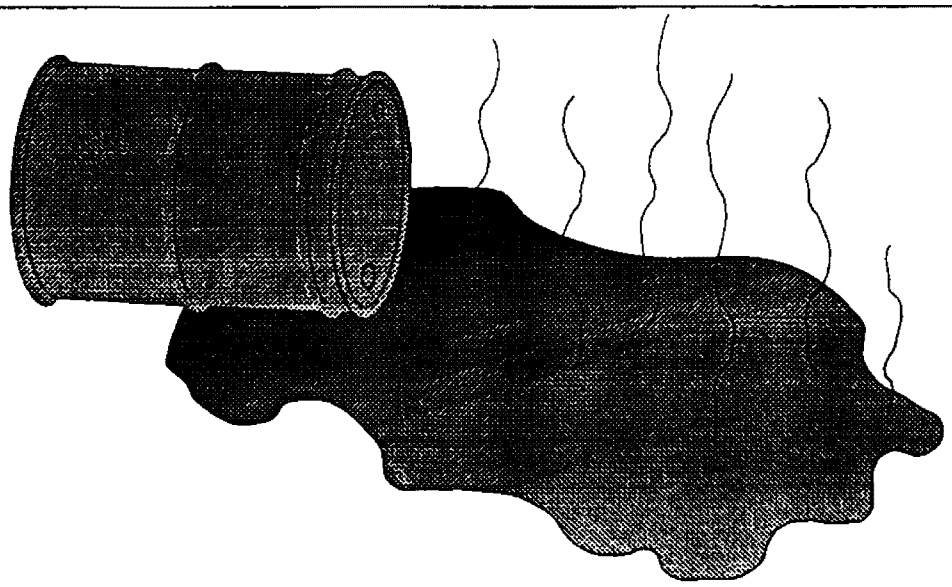
**Hazardous Chemicals Experts**
- Provide immediate advice for handling emergencies

**Fire Fighters**
- Fight site fires and rescue victims

**Meteorologists**
- Provide meteorological information

**Public Safety Personnel**
- Provide site control and help with evacuations

# Emergency Recognition and Prevention



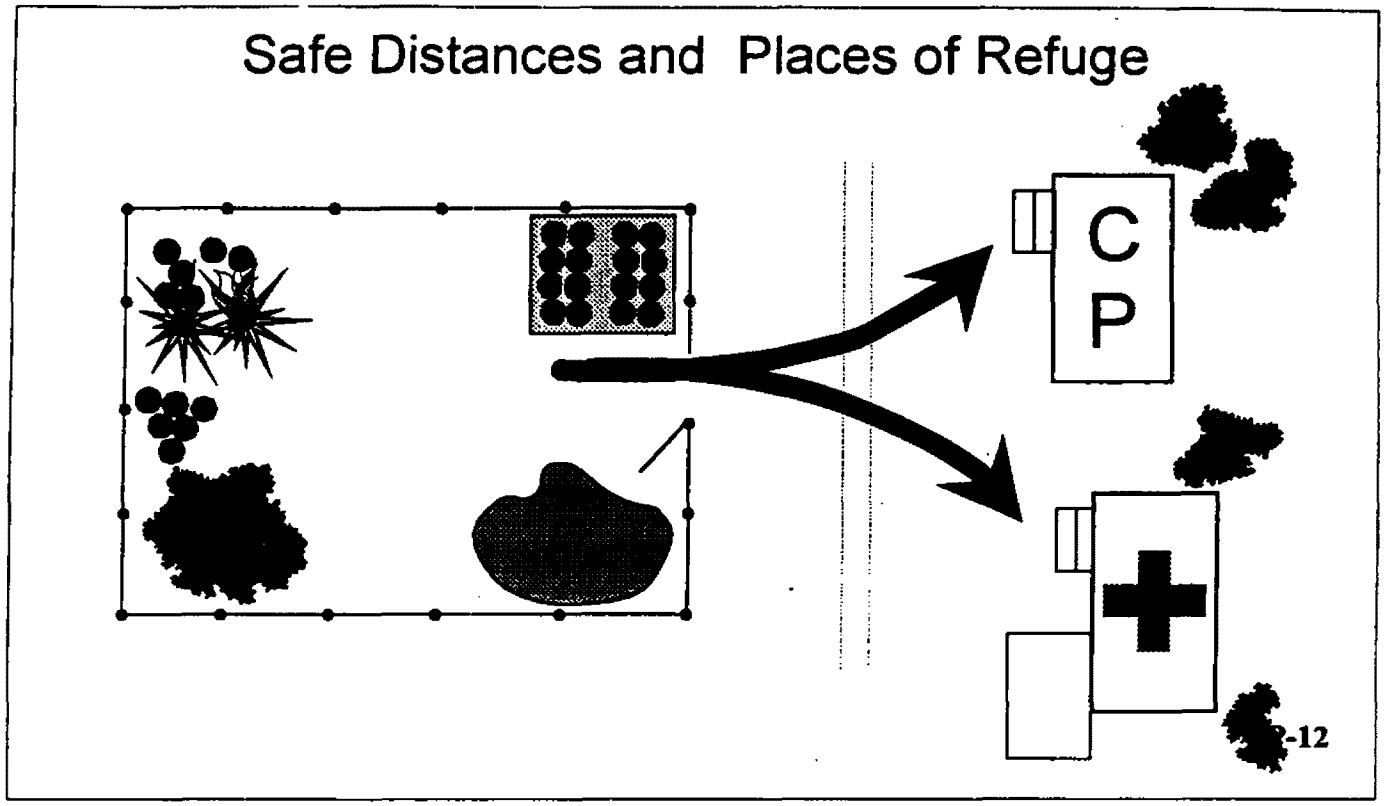
TP-11

## *Emergency Recognition and Prevention*

On a day-to-day basis, individual personnel should be constantly alert for indicators of potentially hazardous situations and for signs and symptoms in themselves and others that warn of hazardous conditions and exposures. Rapid recognition of dangerous situations can avert an emergency. *Before daily work assignments, regular meetings should be held.* Discussion should include:

- Tasks to be performed.
- Time constraints (e.g., rest breaks, air tank changes).
- Hazards that may be encountered, including their effects, how to recognize symptoms or monitor them, concentration limits, or other danger signals.
- Emergency procedures.

*After daily work assignments, a debriefing session should be held to review work accomplished and problems observed.*




## *Safe Distances and Places of Refuge*

*Safe distances can only be determined at the time of an emergency,* based on a combination of site- and incident- specific factors. However, planning and outlining potential emergency scenarios will help familiarize personnel with points to consider.

Factors that influence safe distances include:

- Toxicological properties of the substance
- Physical state of the substance
- Quantity released
- Rate of release
- Method of release
- Vapor pressure of the substance
- Vapor density relative to air
- Wind speed and direction
- Atmospheric stability
- The height of release
- Air temperature and temperature change with altitude
- Local topography (e.g., barriers may enhance or retard a cloud or plume, and attenuate a blast)

## *Safe Distances and Places of Refuge (cont.)*

Onsite refuges (safety stations) can be set up for localized emergencies that do not require site evacuation. These refuges should only be used for essential needs, such as short rest breaks, emergency response strategy meetings, or temporary relief during mild cases of muscle strain and heat stress.

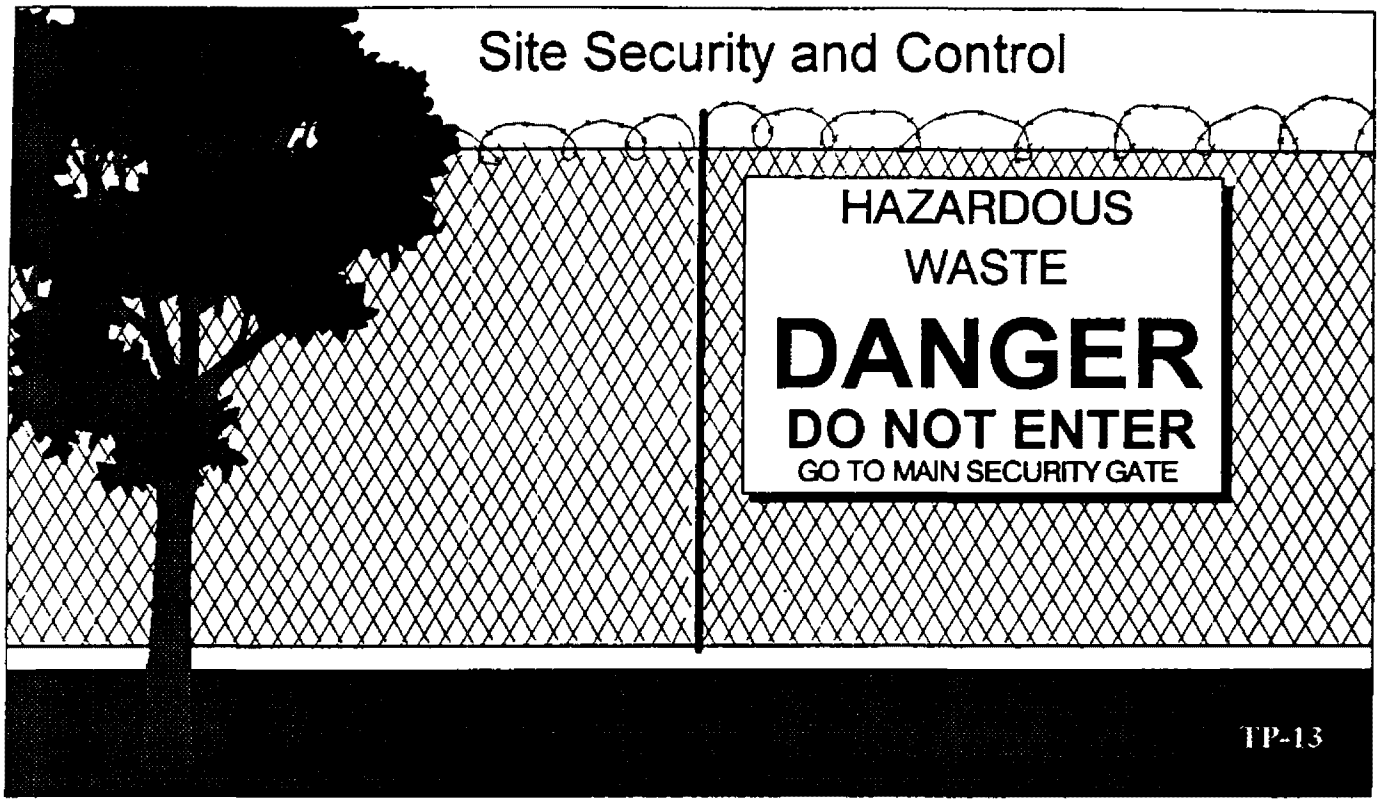
Other refuges can be set up in the Support Zone, or in the case of site-wide evacuations, offsite at the safe exit destination.

Suggestions for onsite refuges:

- A sitting/resting area that is shaded if possible
- Water for decontamination
- Wind indicator
- Communication system with the Command Post
- First aid supplies (e.g., eyewash, stretcher, blanket)
- Special monitoring devices (e.g., extra detector tubes and personal monitors)
- Bolt cutters
- Fire extinguishers
- Hand tools

Suggestions for offsite refuges:

- Decontamination supplies
- Oxygen and/or air
- Water
- Special testing equipment (e.g., pH paper, cyanide paper)
- First aid supplies
- Communication system

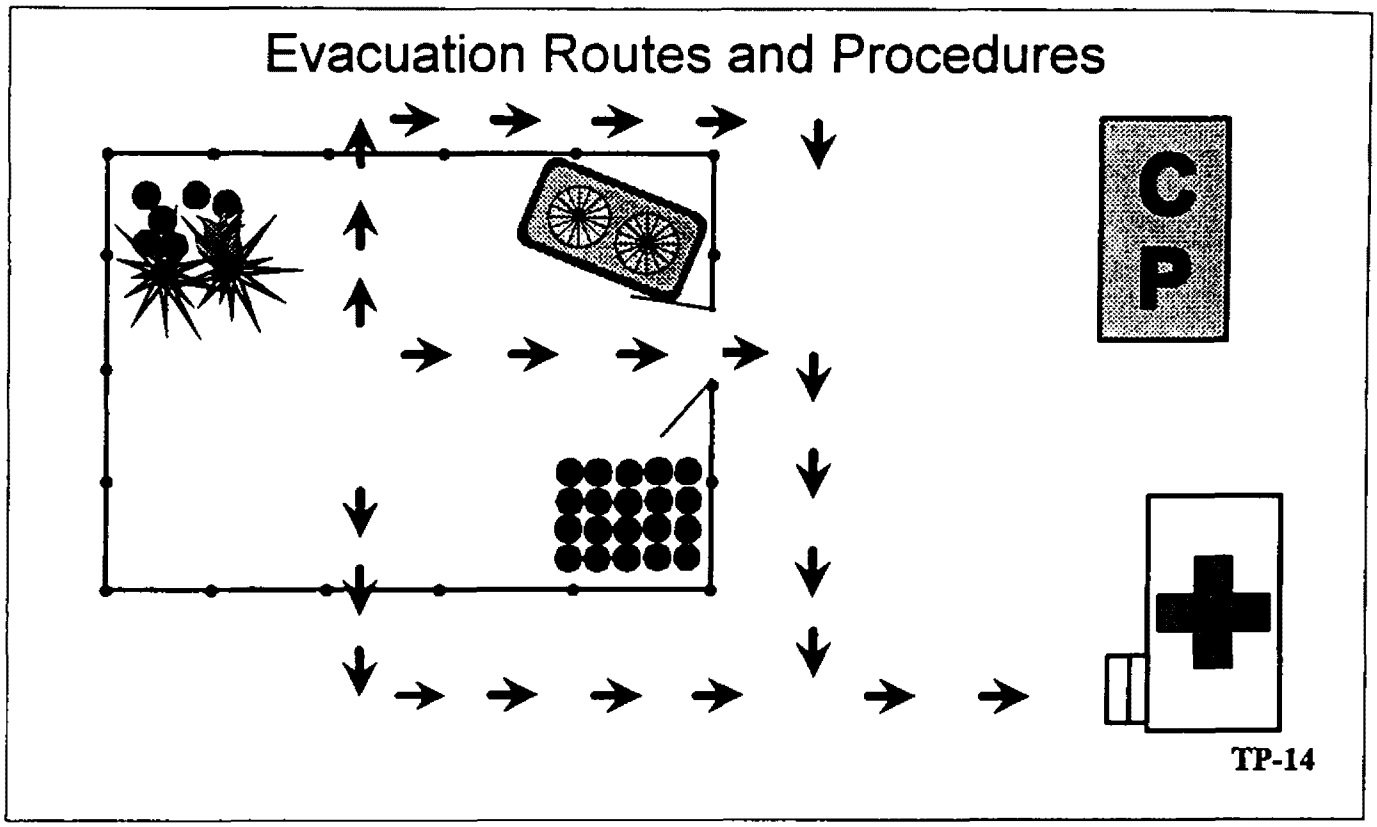



## *Site Security and Control*

*In an emergency, the Project Team Leader (or designated representative) must know who is onsite and must be able to control the entry of personnel into the hazardous areas* to prevent additional injury and exposure. Only necessary rescue and response personnel should be allowed into the Exclusion Zone.

*One control technique is a checkpoint* or series of checkpoints through which all personnel entering or exiting the site must pass, e.g., a Support Zone checkpoint and an Exclusion Zone checkpoint. Identification or authorization must be presented to a Checkpoint Control Manager, who records each person's:

- Name (and affiliation if offsite personnel)
- Status (in or out)
- Time of entry
- Anticipated exit time
- Zones or areas to be entered
- Team or "buddy"
- Task being performed
- Location of task
- Protective equipment worn; air time left
- Rescue and response equipment used




## *Evacuation Routes and Procedures*

A severe emergency, such as a fire or explosion, may cut workers off from the normal exit near the Command Post. Therefore, alternate routes for evacuating victims and endangered personnel should be established in advance, marked, and kept clear. Routes should be directed (1) from the Exclusion Zone through an upwind Contamination Reduction Zone to the Support Zone, and (2) from the Support Zone to an offsite location in case conditions necessitate a general site evacuation.

- *Place the evacuation routes in the predominantly upwind direction of the Exclusion Zone.* (At a very large site, or one with many obstacles, some exits may be placed in the downwind fenceline, normally an undesirable location. If this is done, workers must know that they are not "out" until they reach the designated safety area.)

- *Run the evacuation routes through the Contamination Reduction Zone.* Even if there is not enough time to process the evacuees through decontamination procedures, there should be a mechanism for accounting for all personnel.

- *Consider the accessibility of potential routes.* Take into account obstructions such as locked gates, trenches, pits, tanks, drums, or other barriers, and the extra time or equipment needed to maneuver around or through them.

## *Evacuation Routes and Procedures (cont.)*

- *Develop two or more routes* that lead to safe areas and that are separate or remote from each other. Multiple routes are necessary in case one is blocked by a fire, spill, or vapor cloud. These routes must not overlap because if a common point were obstructed by a fire or other emergency, all intersecting routes would be blocked.

- *Mark routes "safe" or "not safe"* on a daily basis according to wind direction and other factors.

- *Mark evacuation routes with materials such as barricade tape, flagging, or traffic cones.* Equally important, mark areas that do not offer safe escape or that should not be used in an emergency, such as low ground, which can fill with gases or vapors, or routes blocked by natural barriers, such as cliffs or streams.

- *Consider the mobility constraints of personnel wearing protective clothing and equipment.* They will have difficulty crossing even small streams and going up and down banks.

  - Place ladders across any cut or excavation that is more than 3 ft (1 m) deep. For long cuts, place ladders at least every 25 ft (7.5 m), and for deep cuts, place plywood or planks on top of ladders.

  - Provide ladders for rapid descent from areas or structures elevated more than 3 ft (1 m).

  - Use only ladders capable of supporting a 250-lb (114-kg) load.

  - Secure ladders to prevent slipping.

  - Place standard cleated ramps ("chickenboard") across ditches and other similar obstacles. Add a railing and toe boards if the board is narrow or steeply sloped.

  - Check the toe and body clearance of ladders to make sure that personnel wearing protective clothing and self-contained breathing apparatus (SCBA) can use them.

  - Check the clearance of access ports, such as crawlspaces, hatches, manholes, and tunnels to make sure that personnel wearing a protective ensemble can get through. In any case, access ports should be at least 3 ft (1 m) in diameter where possible. (Standard tank manways are smaller.)

## *Decontamination Not Covered by Site Health and Safety Plan*

*When planning for decontamination in medical emergencies, procedures should be developed for:*

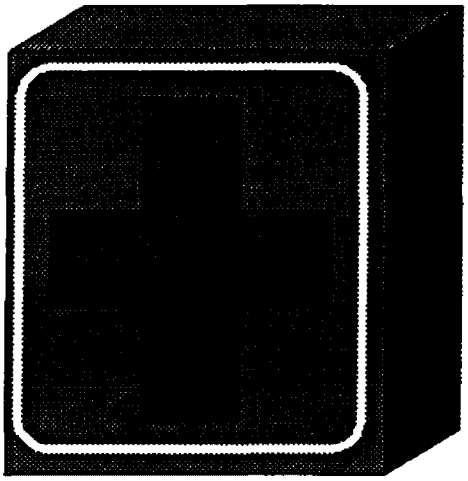
- Decontaminating the victim
- Protecting medical personnel
- Disposing of contaminated protective equipment and wash solutions

These activities should be coordinated. The decision whether or not to decontaminate a victim is based on the type and severity of the illness or injury and the nature of the contaminant. For some emergency victims, immediate decontamination may be an essential part of lifesaving first aid. For others, decontamination may aggravate the injury or delay lifesaving treatment. If decontamination does not interfere with essential treatment, it should be performed.

- *If decontamination cannot be done:*
  - Wrap the victim in blankets, plastic, or rubber to reduce contamination of other personnel.
  - Alert emergency and offsite medical personnel to potential contamination; instruct them about specific decontamination procedures if necessary.
  - Send along site personnel familiar with the incident.

[See Standard Operating Safety Guides (U.S. EPA 1992), Chapter 9, Decontamination (pages 103–109), for details on decontamination techniques and procedures.]

# Emergency Medical Treatment and First Aid



TP-16

## *Medical Treatment/First Aid*

In emergencies, toxic exposure and hazardous situations that cause injuries and illnesses will vary from site to site. Medical treatment may range from bandaging of minor cuts and abrasions to lifesaving techniques. In many cases, essential medical help may not be immediately available. For this reason, it is vital to train onsite emergency personnel in on-the-spot treatment techniques, to establish and maintain telephone contact with medical experts (e.g., toxicologists), and to establish liaisons with local hospitals and ambulance services. Guidelines for establishing an emergency program are detailed in Chapter 5 of the 4-Agency manual.

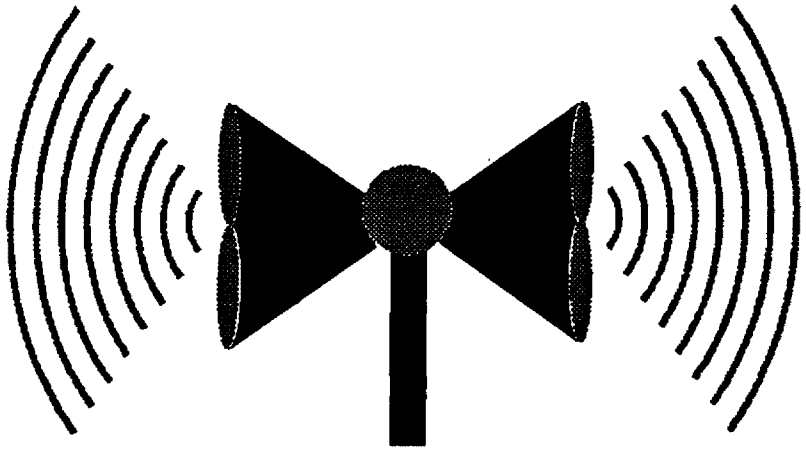
When designing this program, these essential points should be included:

- *Train a cadre of personnel in emergency treatment* such as first aid and CPR. Training should be thorough, frequently repeated, and geared to site-specific hazards.

- *Establish liaison with local medical personnel,* for example: 24-hour on-call physician, medical specialists, local hospitals, ambulance service, and poison control center. Inform and educate these personnel about site-specific hazards so that they can be optimally helpful if an emergency occurs. Develop procedures for contacting them and familiarize all onsite emergency personnel with these procedures.

- *Set up onsite emergency first aid stations;* see that they are well supplied and restocked immediately after each emergency.

# Emergency Alerting and Response Procedures



TP-17

## *Emergency Alerting and Response Procedures*

**Notification**

- *Alert personnel to the emergency.* Sound a site alarm to:
  - Notify personnel.
  - Stop work activities if necessary.
  - Lower background noise in order to speed communication.
  - Begin emergency procedures.

- *Notify onsite emergency response personnel about the emergency* and include essential information:
  - What happened.
  - Where it happened.
  - Whom it happened to.
  - When it happened.
  - How it happened.
  - The extent of damage.
  - What aid is needed.

*Rescue and response action* is based on the available information, the type of action required, and the necessary steps implemented. Some actions may be done concurrently. No one should attempt emergency response or rescue until backup personnel and evacuation routes have been identified.

Rescue/response actions may include:

- *Enforce the buddy system:* Allow no one to enter an Exclusion Zone or hazardous area without a partner.

- *Survey casualties*

- *Assess existing and potential hazards* to site personnel and to the offsite population.

- *Allocate resources:* Allocate onsite personnel and equipment to rescue and incident response operations.

- *Request aid:* Contact the required offsite personnel or facilities, such as the ambulance, fire department, and police.

- *Control:* Bring the hazardous situation under complete or temporary control; use measures to prevent the spread of the emergency.

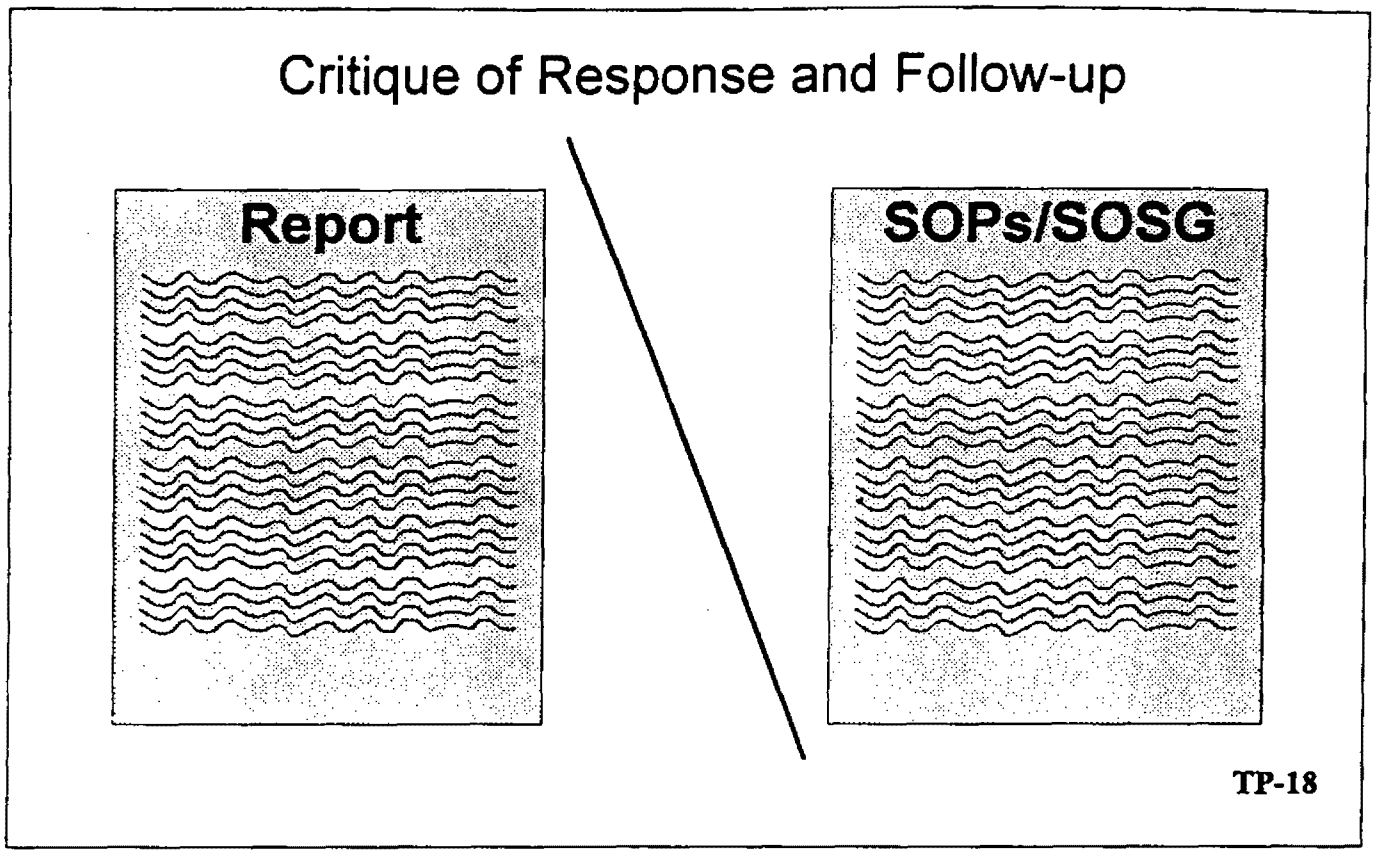
- *Extricate:* Remove or assist victims from the area.

- *Decontaminate:* Use established procedures to decontaminate uninjured personnel in the Contamination Reduction Zone. If the emergency makes this area unsafe, establish a new decontamination area at an appropriate distance. Decontaminate victims before or after stabilization as their medical condition indicates [see Figure 12-1 for decision aid (page 12-8 of the 4-Agency manual)].

- *Stabilize:* Administer any medical procedures that are necessary before the victims can be moved. Stabilize or permanently fix the hazardous condition (e.g., empty filled runoff dikes). Attend to what caused the emergency and anything damaged or endangered by the emergency (e.g., drums, tanks).

- *Transport:* Take measures to minimize chemical contamination of the transport vehicles, ambulance, and hospital personnel. Adequately protected rescuers should decontaminate the victims before transport. If this is not possible, cover the victims with adequate sheeting. Before transportation, determine the level of protection necessary for transport personnel. Provide them with disposable coveralls and gloves, and supplied air, as necessary, for their protection. If appropriate, have response personnel accompany victims to the medical facility to advise on decontamination.

- *Evacuate:*
  - Move site personnel to a safe distance upwind of the incident.
  - Monitor the incident for significant changes. The hazards may diminish, permitting personnel to reenter the site, or the hazards may increase, requiring public evacuation.
  - Inform public safety personnel when there is a potential or actual need to evacuate the offsite population. Do <u>not</u> attempt large-scale public evacuation. This is the responsibility of government authorities [see Table 12-3 (page 12-3 of the 4-Agency manual)].




## *Critique of Response and Follow-up*

Critique:

- *Coordinate a formal critique with all parties involved* in the emergency. Complete a critique report with recommendations to improve standard operating safety guidelines, if necessary.

- *Review and revise all aspects of the ERP* according to new site conditions and lessons learned from the emergency response. When reviewing the information, consider typical questions such as:

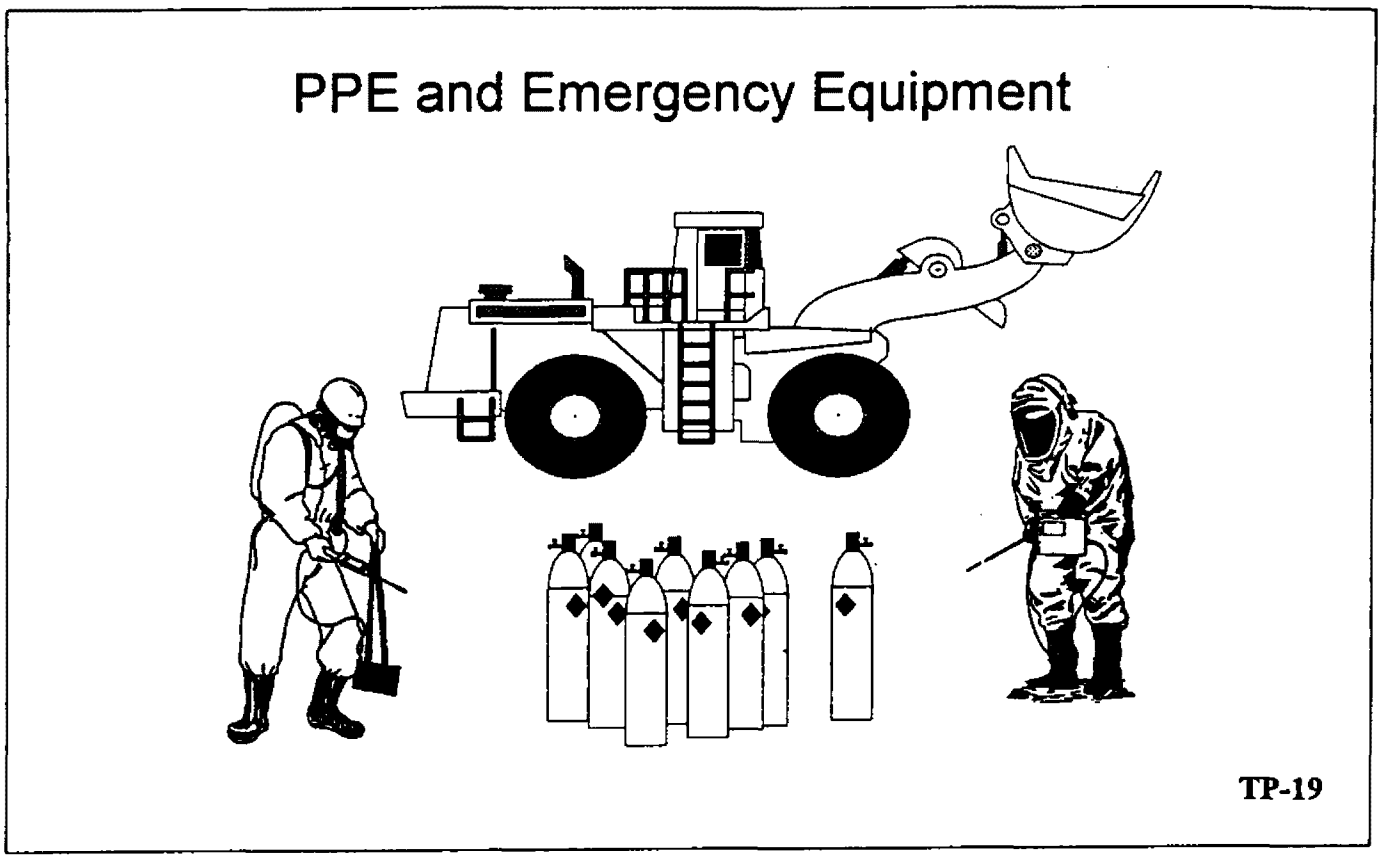
  - *Cause:* What caused the emergency?
  - *Prevention:* Was it preventable? If so, how?
  - *Procedures:* Were inadequate or incorrect orders given or actions taken? Were these the result of bad judgment, wrong or insufficient information, or poor procedures? Can procedures or training be improved?
  - *Site profile:* How does this incident affect the site profile? How are other site cleanup activities affected?
  - *Community:* How is community safety affected?
  - *Liability:* Who is liable for damage payments?

## *Critique of Response and Follow-up (cont.)*

Follow-up:

- *Before normal site activities are resumed,* personnel must be fully prepared and equipped to handle another emergency.

  - *Notify appropriate government agencies* as required. For example, the Occupational Safety and Health Administration (OSHA) must be notified if there have been any fatalities or five or more hospitalizations.
  - *Restock all equipment and supplies.* Replace or repair damaged equipment. Clean and refuel equipment for future use.
  - *Amend the ERP* based on the critique and changing site conditions.




## *PPE and Emergency Equipment*

PPE:

- *Refill all empty SCBA tanks* and prepare them for emergencies immediately after normal use.
- *Stock higher levels of protective equipment than required* for anticipated hazards (e.g., a site where Level C equipment is normally used should have Level A and B equipment available for emergencies).
- *Provide personal protection, including:*
  - Escape SCBA or SCBA, which can be brought to the victim to replace or supplement his or her SCBA.
  - PPE and clothing specialized for known site hazards.

Medical:

- Air splints
- Antiseptics
- Blankets
- Decontamination solutions appropriate for onsite chemical hazards
- Emergency eye wash

## PPE and Emergency Equipment (cont.)

Medical:

- Air splints
- Antiseptics
- Blankets
- Decontamination solutions appropriate for onsite chemical hazards
- Emergency eye wash
- Emergency showers or wash stations
- Ice
- Reference books containing basic first aid procedures and information on treatment of specific chemical injuries
- Resuscitator
- Safety harness
- Stretchers
- Water, in portable containers
- Wire basket litter (Stokes litter), which can be used to carry a victim in bad weather and on a difficult terrain, allows easy decontamination of the victim, and is itself easy to decontaminate.

Hazard Mitigation:

- Fire fighting equipment and supplies
- Spill containment equipment, such as absorbents and oil booms
- Special hazardous-use tools such as remote pneumatic impact wrenches, nonsparking wrenches and picks.
- Containers to hold contaminated materials

In an emergency, equipment will be necessary to rescue and treat victims, to protect response personnel, and to mitigate hazardous conditions onsite (e.g., to contain chemicals or fight fires). Some regular equipment can double for emergency use. Because of its high cost, most heavy equipment (e.g., bulldozers, drum movers, pumps) employed in emergencies will also be used for regular work assignments.

All equipment should be in working order, fueled, and available when an emergency occurs. Provide safe and unobstructed access for all firefighting and emergency equipment at all times. Consider adopting the following work procedures:

- Refuel all heavy equipment when there is still one-half to one-quarter of a tank of fuel left.
- Require all equipment repairs to take place at the time the problem is discovered.
- Separate two similar pieces of equiment (e.g., two front-loaders or a bulldozer and a front-loader); park each at a different spot onsite and do not use them at the same time in a hazardous area.

## Procedures for Handling Emergencies

- ____ topography, layout, and prevailing weather conditions.
- Procedures for _____ incidents to local, state, and federal governmental agencies.

*Source:* 29 CFR 1910.120(l)(3)

**TP-20**

## Procedures for Handling Emergencies (cont.)

- The ERP shall be a separate _____ of the site health and safety plan.
- The ERP shall be compatible and _____ with the disaster, fire/emergency response plans of local, state, and federal governmental agencies.
- The ERP shall be _____ regularly as part of the overall training program.

*Source:* 29 CFR 1910.120(l)(3)

**TP-21**

## Procedures for Handling Emergencies (cont.)

- The ERP shall be _____ periodically and, as necessary, be amended to keep it current with new or changing site conditions or information.
- An alarm system shall be installed in accordance with 29 CFR 1910.165 to _____ employees of an emergency situation.
- Based upon available information at the time of the emergency, the employer shall _____ the incident and the site response capabilities and proceed with appropriate steps to implement the site ERP.

*Source:* 29 CFR 1910.120(l)(3)

**TP-22**

Given 29 CFR 1910.38 and 29 CFR 1910.120(1):

- List the similarities between an ERP and EAP.
- List the differences between an ERP and EAP.

## ERP/EAP Comparisons

**ERP Elements**

1. _____ Pre-emergency Planning
2. B, F, E Personnel roles, lines of authority and communication
3. _____ Emergency recognition and prevention
4. A, C Safe distances and places of refuge
5. C, E Site security and control
6. A, C, E Evacuation routes and procedures
7. D Decontamination procedures not covered by site health and safety plan
8. D Emergency medical treatment and first aid
9. A Emergency alerting and response procedures
10. _____ Critique of response and follow-up
11. D PPE and emergency equipment

**EAP Elements**

A. Emergency escape procedures
B. Critical operations
C. Accounting for employees
D. Rescue and medical duties
E. Reporting emergencies
F. Names for further information

Find and circle the key words or phrases that complete the six elements of an EAP. Words and phrases are listed vertically and horizontally ***only***. Words or phrases *may be used more than once.* Fill in the blanks with the appropriate words or phrases for each of the six EAP elements.

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| X | T | E | F | O | L | L | O | W | E | D | H | I | N | I | B | S | B | N | O | R | M | U | B | U | W | E |
| R | M | E | A | W | R | F | P | A | G | P | R | E | B | N | O | C | L | M | T | E | G | W | I | H | E | S |
| M | P | I | G | B | Q | K | E | O | C | X | O | J | A | F | K | A | S | E | M | P | L | O | Y | E | E | S |
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| F | E | E | M | L | X | V | A | N | C | P | G | L | K | R | N | E | F | I | R | E | F | X | I | J | I | Q |
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EAP Elements

1. Emergency _____ _____ and _____ ____ assignments.
2. _____ to be _____ by employees who _____ to _____ critical ____ _____ before they evacuate.
3. _____ to _____ ___ all _____ after emergency _____ has been completed.
4. _____ and _____ _____ for those _____ who are to _____ them.
5. The _____ _____ of _____ fires and other _____.
6. Names or regular ___ ____ of persons or departments who can be _____ for further _____ or _____ of _____ under the plan.

Given federal legislation, describe the purpose of SARA Title III.

## SARA Title III

The Emergency Planning and Community Right-to-Know Act of 1986:

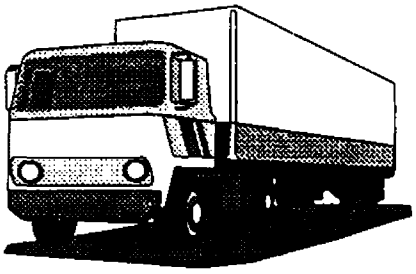
Establishes requirements for federal, state, and local governments and industry in _____ for emergencies and reporting on use, storage, and releases of hazardous and toxic chemicals.

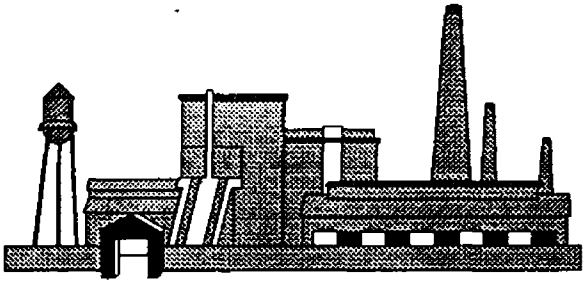
*Adapted from:* SARA Title III Fact Sheet, EPA/550-F-93-002 **TP-23**

Given SARA Title I and Title III planning elements, identify their similarities and differences.

## Title III Planning Elements

1. Identification of _____ and transportation routes within the scope of the act

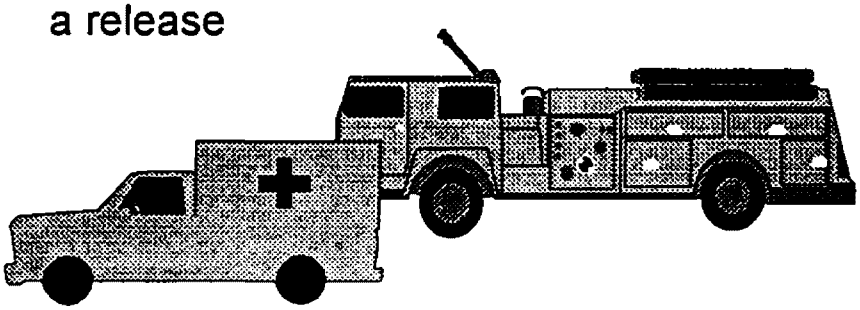




TP-24

## Title III Planning Elements (cont.)

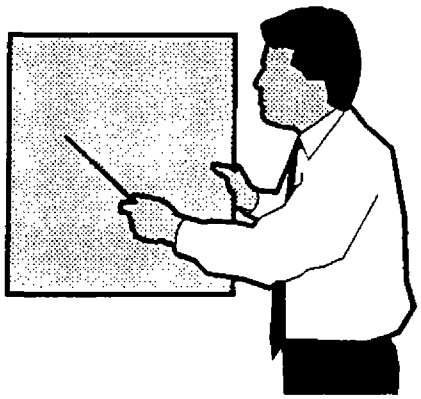
2. Methods and _____ of emergency response for facility owners/operators and community fire/EMS personnel to respond to a release



TP-25

## Title III Planning Elements (cont.)

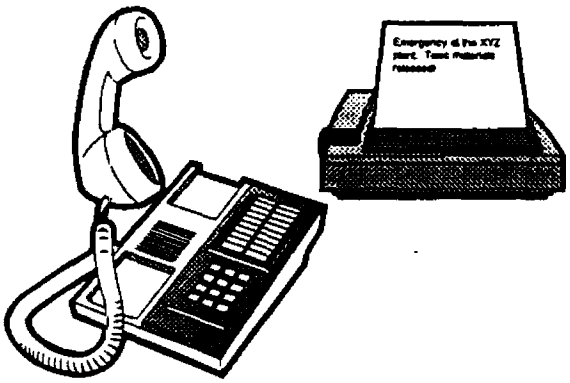
3. Designation of community and facility emergency _____



TP-26

## Title III Planning Elements (cont.)

4. Procedures providing reliable, effective, and timely _____ of a release at a facility



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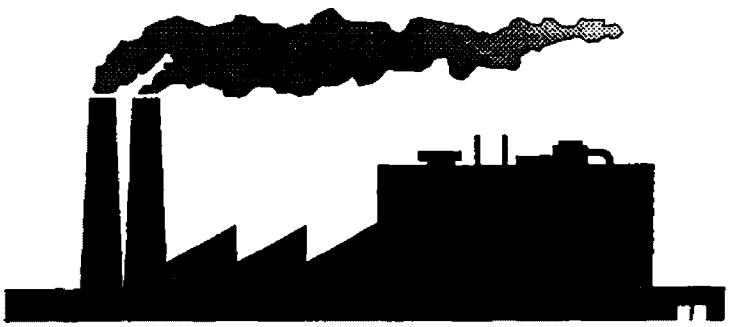
## Title III Planning Elements (cont.)

5. Methods for determining the occurrence of a _____, and the area or population that will be affected by the release



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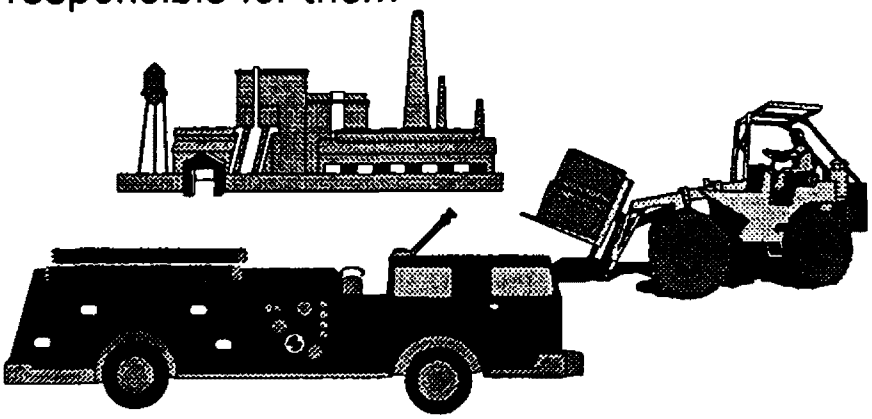
# Title III Planning Elements (cont.)

6. Community and facility emergency _____ and facilities, and identity of persons responsible for them



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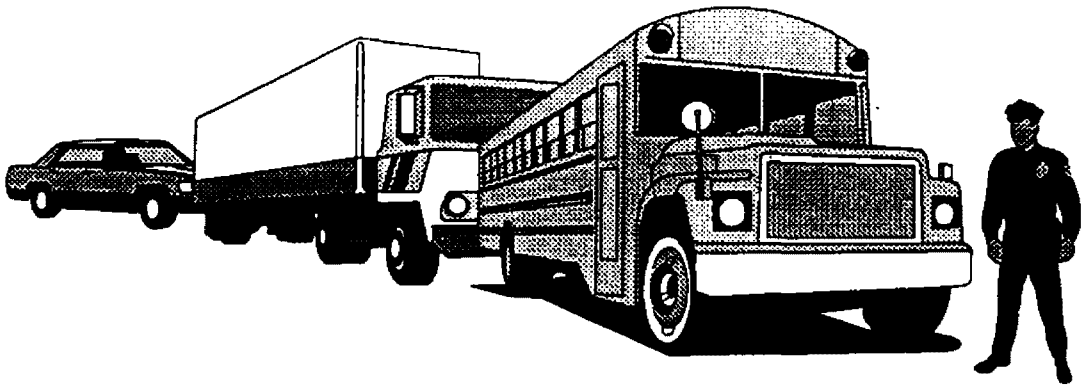
# Title III Planning Elements (cont.)

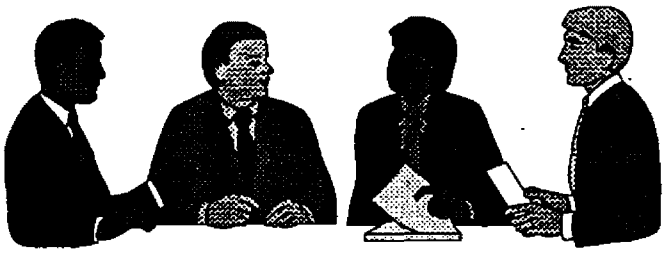
7. Evacuation _____ and alternate traffic routes



TP-30

# Title III Planning Elements (cont.)

8. _____ programs and schedules of training for local responders



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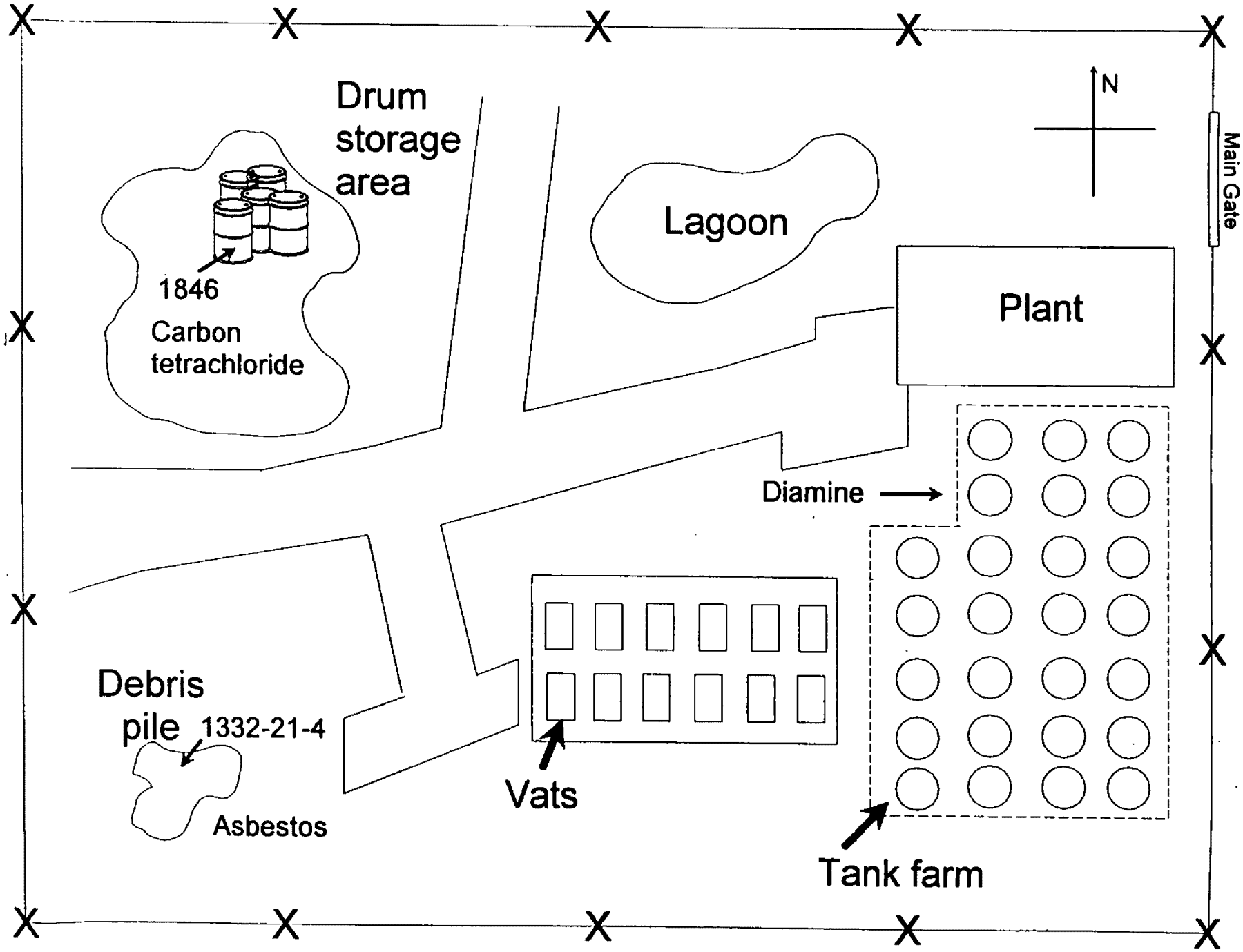
# Title III Planning Elements (cont.)

9. Methods and plans for _____ the emergency plan

TP-32

# The Blue Ridge Chemical Facility



## Conclusion

- Confined Space Entry Program
- Spill Containment Program
- **Emergency Response Plans**

**TP-33**

### Crossword Puzzle

**Down**

2. An emergency_____ plan provides for the safety of workers responding to a site emergency
31. An emergency_____plan provides for the safe and orderly evacuation of a site

# APPENDIX
## SARA Title III Fact Sheet

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United States
Environmental Protection
Agency

Solid Waste And
Emergency Response
(OS-120)

EPA 550-F-93-002
January 1993
Series 9, No. 3

EPA

# SARA Title III Fact Sheet

## Emergency Planning And Community Right-To-Know Act

### United States Environmental Protection Agency

### Overview

The Emergency Planning and Community Right-to-Know Act of 1986 establishes requirements for Federal, State and local governments and industry regarding emergency planning and "Community Right-to-Know" reporting on hazardous and toxic chemicals. This law builds upon EPA's Chemical Emergency Preparedness Program (CEPP) and numerous State and local programs aimed at helping communities to better meet their responsibilities in regard to potential chemical emergencies. The Community Right-to-Know provisions will help to increase the public's knowledge and access to information on the presence of hazardous chemicals in their communities and releases of these chemicals into the environment. States and communities, working with facilities, will be better able to improve chemical safety and protect public health and the environment.

Nothing in this document should be construed to indicate that EPA has determined states have Title III authority over Indian reservations. For purposes of this document, definition of the terms "State" and "Governor" includes "Indian Tribe" and "Tribal Chairman." EPA has issued a final rule on July 26, 1990, regarding the application of the Emergency Planning and Community Right-to-Know law to Indian lands.

The Emergency Planning and Community Right-to-Know Act (also known as SARA Title III or EPCRA) provisions has four major sections: emergency planning (Section 301-303), emergency release notification (Section 304), community Right-to-Know reporting requirements (Sections 311, 312) and toxic chemical release inventory (Section 313). Information from these four reporting requirements will help States and communities develop a broad perspective of chemical hazards for the entire community as well as for individual facilities.

### Section 301-303: Emergency Planning

The emergency planning sections are designed to develop State and local governments' emergency response and preparedness capabilities through better coordination and planning, especially within the local community.

### State Emergency Response Commission

The Emergency Planning and Community Right-to-Know Act required the Governor of each state to designate a State Emergency Response Commission (SERC). Many SERCs include public agencies and departments concerned with issues relating to environment, natural resources, emergency services, public health, occupational safety, and

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## Rulemakings in the Federal Register

| | | |
|---|---|---|
| April 22, 1987 | 301-303 | EPA published final List of Extremely Hazardous Substances and Threshold Planning Quantities as well as Final Rule for Sections 302, 303, and 304 of the law. |
| October 15, 1987 | 311-312 | EPA published final format for emergency inventory forms and reporting requirements as well as the Final Rule for Sections 311 and 312 of the law. |
| December 17, 1987 | 301-303 | EPA published a Final Rule delisting four chemicals from the Extremely Hazardous Substance List. |
| February 16, 1988 | 313 | EPA published the final Toxic Chemical Release forms and instructions as well as the Final Rule for Section 313 of the law. |
| February 25, 1988 | 301-303 | EPA published a Final Rule delisting 36 chemicals from the Extremely Hazardous Substance List. |
| July 29, 1988 | 322 | EPA published a Final Rule governing trade secret claims. |
| January 23, 1989 | 301-303 | EPA published a Proposed Rule designating several Extremely Hazardous Substances as CERCLA Hazardous Substances. |
| January 26, 1989 | 325 | EPA published a Proposed Rule governing policies and procedures for Citizens Suits under the law. |
| July 24, 1990 | 304 | EPA published a Final Rule for the continuous release reporting regulation, under which the SERCs and LEPCs will receive both initial telephone notifications and written reports about the continuous releases. |
| July 26, 1990 | 311-312 | EPA published a Final Rule on the reporting requirements for Sections 311 and 312. |
| August 27, 1990 | 301-304 | EPA published an Advanced Notice of Proposed Rulemaking seeking comments on a proposal to specify criteria that would be used to add chemicals to the Extremely Hazardous Substances list. |
| September 25, 1991 | 313 | EPA published a proposed rule on the additional requirements under Section 313 as mandated by the Pollution Prevention Act. |

NOTE: The middle column denotes the section of the Title III law which applies to the rulemakings in the Federal Register. These are not all-inclusive.

transportation. Also, interested public and private sector groups and associations with experience in emergency planning and Community Right-to-Know issues may be included in the State commission. At this time, all governors have established SERCs.

The SERC must also have designated local emergency planning districts and appointed Local Emergency Planning Committees (LEPC) for each district. SERCs have designated over 4,000 local districts. Thirty-five State commissions chose counties as the basic district designation (often with separate districts for municipalities) and ten SERCs designated substate planning districts. The SERC is responsible for supervising and coordinating the activities of the LEPC, for establishing procedures for receiving and processing public requests for information collected under other sections of SARA Title III, and for reviewing local emergency plans.

### Local Emergency Planning Committees

This LEPC must include, at a minimum, elected state and local officials, police, fire, civil defense, public health professionals, environmental, hospital, and transportation officials as well as representatives of facilities subject to the emergency planning requirements, community groups, and the media. As soon as facilities are subject to the emergency planning requirements, they must designate a

representative to participate in the planning process.

The LEPC is required to complete a number of tasks, including establishing rules, giving public notice of its activities, and establishing procedures for handling public requests for information; however, the LEPC's primary responsibility is to develop an emergency response plan by October 17, 1988 and review it at least annually thereafter. In developing this plan, the LEPC evaluates available resources for preparing for and responding to a potential chemical accident. The plan must:

- identify facilities and transportation routes of extremely hazardous substances;
- describe emergency response procedures, on-site and off-site;
- designate a community coordinator and facility coordinator(s) to implement the plan;
- outline emergency notification procedures;
- describe methods for determining the occurrence of a release and the probable affected area and population;
- describe community and industry emergency equipment and facilities and identify the persons responsible for them;
- outline evacuation plans;
- describe a training program for emergency response personnel (including schedules); and,
- present methods and schedules for exercising emergency response plans.

## Emergency Response Plans

In order to assist the LEPCs in preparing and reviewing plans, Congress required the National Response Team (NRT), composed of 15 Federal agencies with emergency response responsibilities, to publish guidance on emergency response planning. This guidance, the "Hazardous Materials Emergency Planning Guide, (NRT-1)" was published by the NRT in March 1987. In 1990, the NRT also published "Developing a Hazardous Materials Exercise Program: A Handbook for State and Local Officials (NRT-2)" to help assist SERCs and LEPCs exercise their emergency response plans.

The emergency response plan must be initially reviewed by the SERC and, at least, annually by the LEPC. Regional Response Teams (RRTs), composed of federal regional officials and state representatives, may review the plans and provide assistance to the LEPCs upon request by the SERC or LEPC.

Planning activities of LEPCs and facilities should be initially focused on, but not limited to, the 360 extremely hazardous substances published in the Federal Register. Plans should be comprehensive, addressing all hazardous materials of concern and transportation as well as fixed facilities. The list includes the threshold planning quantities (minimum limits) for each substance (see Code of Federal Regulations (CFR) Part 40, Section 355). Through rulemaking, EPA can revise the list and threshold planning quantities based on the toxicity, reactivity, volatility, dispersability, combustibility, or flammability of a substance.

Any facility that has present any of the listed chemicals in a quantity equal to or greater than its threshold planning quantity is subject to the emergency planning requirements. In addition, the SERC or the Governor can designate additional facilities, after public comment, to be subject to these requirements. Covered facilities must notify the SERC and LEPC that they are subject to these requirements within 60 days after they begin to have present any of the extremely hazardous substances in an amount equal to or in excess of threshold planning quantities.

In addition, the SERC must notify the EPA regional office of all facilities subject to the emergency planning requirements, including facilities designated by the SERC or the governor.

**Section 304:**
**Emergency Notification**

Facilities must immediately notify the LEPCs and the SERCs likely to be affected if there is a release into the environment of a hazardous substance that exceeds the reportable quantity for that substance. Substances subject to this requirement are those on the list of 360 extremely hazardous substances as published in Federal Register (40 CFR 355) as well as the more than 700 hazardous substances subject to the emergency notification requirements under CERCLA Section 103(a) (40 CFR 302.4). Some chemicals are common to both lists. The CERCLA hazardous substances also require notification of releases to the National Response Center (NRC), which alerts federal responders.

Initial notification can be made by telephone, radio, or in person. Emergency notification requirements involving transportation incidents can be met by dialing 911, or in the absence of a 911 emergency number, calling the operator.

This emergency notification needs to include:

- The chemical name;
- An indication of whether the substance is extremely hazardous;
- An estimate of the quantity released into the environment;
- The time and duration of the release;
- Whether the release occurred into air, water, and/or land;
- Any known or anticipated acute or chronic health risks associated with the emergency, and where necessary, advice regarding medical attention for exposed individuals;
- Proper precautions, such as evacuation or sheltering in place; and,
- Name and telephone number of contact person.

Section 304 also requires a written follow-up emergency notice as soon as practicable after the release. The follow-up notice or notices must:

- Update information included in the initial notice, and
- Provide information on
  - actual response actions taken; and
  - advice regarding medical attention necessary for exposed individuals.

If LEPCs are not yet formed, releases should be reported to appropriate local response officials.

**Section 311-312:**
**Community Right-to-Know Requirements**

There are two Community Right-to-Know reporting requirements within the Emergency Planning and Community Right-to-Know Act. Section 311 requires facilities that must prepare material safety data sheets (MSDS) under the Occupational Safety and Health Administration (OSHA) regulations to submit either copies of their MSDSs or a list of MSDS chemicals to:

- The LEPC,
- The SERC, and,
- The local fire department with jurisdiction over the facility.

If the facility owner or operator chooses to submit a list of MSDS chemicals, the list must include the chemical or common name of each substance and must identify the applicable hazard categories. These hazard categories are:

- Immediate (acute) health hazard,
- Delayed (chronic) health hazard,
- Fire hazard,
- Sudden release of pressure hazard, and,
- Reactive hazard.

If a list is submitted, the facility must submit a copy of the MSDS for any chemical on the list upon the request of the LEPC or SERC. Also, EPA has established threshold quantities for hazardous chemicals below which no facility must report. The current thresholds for Section 311 are:

- For extremely hazardous substances: 500 pounds or the threshold planning quantity, whichever is lower.
- For all other hazardous chemicals: 10,000 pounds.

The initial submission of the MSDSs or a list of MSDS chemicals was due on October 17, 1987, or three months after the facility is required to prepare or have available an MSDS under OSHA regulations. Currently, OSHA regulations require all employers to have or prepare MSDSs for their chemicals. Under the Emergency Planning and Community Right-to-Know statute, facilities newly covered by the OSHA regulations must submit MSDSs or a list of MSDS chemicals within three months after they become covered.

An MSDS or a revised list must be provided when new hazardous chemicals become present at a facility in quantities at or above the established threshold levels after the deadline. A revised MSDS must be provided to update the original MSDS if significant new information is discovered about the hazardous chemical.

Reporting under section 312 requires a facility to submit an emergency and hazardous chemical inventory form to the LEPC, the SERC, and the local fire department with jurisdiction over the facility. Hazardous chemicals covered by section 312 are those for which facilities are required to prepare or have available an MSDS under OSHA's Hazard Communication Standard and that were present at the facility at any time during the previous calendar year above specified thresholds.

The specific threshold quantities established by EPA for Section 312 for hazardous chemicals, below which no facility must report, are:

- For extremely hazardous substances: 500 pounds or the threshold planning quantity, whichever is lower.
- For all other hazardous chemicals: 10,000 pounds.

The inventory form incorporates a "two-tier" approach. Under Tier I, facilities must submit the following aggregate information for each applicable hazard category:

- An estimate (in ranges) of the maximum amount of chemicals for each category present at the facility at any time during the preceding calendar year;
- An estimate (in ranges) of the average daily amount of chemicals in each category; and,
- The general location of hazardous chemicals in each category.

The Tier II report contains basically the same information as the Tier I, but it must name the

specific chemical. If requested by an LEPC, SERC, or local fire department, the facility must provide the following Tier II information for each substance subject to the request:

- The chemical name or the common name as indicated on the MSDS,
- An estimate (in ranges) of the maximum amount of the chemical present at any time during the preceding calendar year,
- A brief description of the manner of storage of the chemical,
- The location of the chemical at the facility, and,
- An indication of whether the owner elects to withhold location information from disclosure to the public.

EPA published a uniform format for the inventory forms on October 15, 1987. However, because many state commissions have additional requirements or have incorporated the federal contents in their own forms, Tier I/II forms should be obtained from the SERC. The Tier I information must be submitted for covered facilities on or before **March 1 annually.**

The Tier II form may be sent by the facility instead of a Tier I form. EPA believes that Tier II reports provide emergency planners and communities with more useful information and encourages facilities to submit Tier II forms. The public may also request Tier II information from the SERC and the LEPC. The information submitted by facilities under Sections 311 and 312 must generally be made available to the public by LEPCs and SERCs during normal working hours.

### Section 313: Toxic Chemical Release Reporting

Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 requires EPA to establish an inventory of routine toxic chemical emissions from certain facilities. Facilities subject to this reporting requirement are required to complete a Toxic Chemical Release Inventory Form (Form R) for specified chemicals. The form must be submitted to EPA and those state officials designated by the governor **annually** on **July 1**. These reports should reflect releases during the preceding calendar year.

The purpose of this reporting requirement is to inform the public and government officials about routine releases of toxic chemicals to the environment. It will also assist in research and the development of regulations, guidelines, and standards.

The reporting requirement applies to owners and operators of facilities that have 10 or more full-time employees, that are in Standard Industrial Classification (SIC) codes 20 through 39 (i.e., manufacturing facilities) and that manufacture (including importing), process, or otherwise use a listed toxic chemical in excess of specified threshold quantities.

Facilities manufacturing or processing any of these chemicals in excess of 25,000 pounds are required to submit the form by July 1st of the following calendar year. Facilities otherwise using listed toxic chemicals in quantities over 10,000 pounds in a calendar year are required to submit toxic chemical release forms by July 1 of the following calendar year. EPA can revise these threshold quantities and covered SIC codes.

The list of toxic chemicals subject to reporting consisted initially of chemicals listed for similar reporting purposes by the States of New Jersey and Maryland. There are over 300 chemicals and categories on these lists. Through rulemaking, EPA can modify this combined list (a current toxic chemical list may be obtained through the EPCRA hotline, see page 9).

The final Toxic Chemical Release Form and regulations were published in the Federal Register

on February 16, 1988. (NOTE: EPA has revised and updated the Toxic Chemical Release Form since that time.) The following information is required on the form:

- The name, location and type of business;
- Off-site locations to which the facility transfers toxic chemicals in waste for recycling, energy recovery, treatment or disposal;
- Whether the chemical is manufactured (including importation), processed, or otherwise used and the general categories of use of the chemical;
- An estimate (in ranges) of the maximum amounts of the toxic chemical present at the facility at any time during the preceding year;
- Quantity of the chemical entering each medium—air, land, and water—annually;
- Waste treatment/disposal methods and efficiency of methods for each waste stream;
- Source reduction and recycling activities; and,
- A certification by a senior facility official that the report is complete and accurate.

Reports are sent to EPA and designated state agencies. EPA established and maintains a national toxic chemical inventory based on the data submitted. The public is able to access this national database and obtain the data through other means. See the **Public Access Section** of this document for further details.

### Pollution Prevention Law

The Pollution Prevention Act of 1990 has significantly expanded the Toxics Release Inventory (TRI). It requires collection of mandatory information on source reduction, recycling, and treatment beginning with the 1991 reporting year. The new requirements include reporting of the following information:

- Amounts released or disposed on-site or off-site, the quantities from the previous year, the quantities anticipated for the next two years;
- Amounts recycled on-site and sent off-site for recycling, the quantities from the previous year, the quantities anticipated for the next two years;
- Amounts treated on-site and sent off-site for treatment, the quantities from the previous year, and the quantities anticipated for the next two years;
- Amounts used for energy recovery on-site and sent off-site, quantities from the previous year, and the quantities anticipated for the next two years;
- Types of source reduction practices implemented and the techniques used to identify those practices;
- Methods of recycling used on-site;
- Production ratio or activity index to track changes in the level of economic activity at a facility; and,
- Amount of releases resulting from one-time events not associated with production processes.

## Other SARA Title III Provisions

### Trade Secrets

Section 322 of the Emergency Planning and Community Right-to-Know Act addresses trade secrets as they apply to emergency planning, Community Right-to-Know, and toxic chemical release reporting. A facility may withhold the specific chemical identity on these submittals. No

trade secrets are allowed to be claimed under Section 304 of the statute. The withholder must show that:

- The information has not been disclosed to any person other than a member of the local planning committee, a government official, an employee of the withholder or someone bound by a confidentiality agreement; measures have been taken to protect the confidentiality; and the withholder intends to continue to take such measures;

- The information is not required to be disclosed to the public under any other Federal or State law;

- Disclosure of the information is likely to cause substantial harm to the competitive position of the withholder; and,

- The chemical identity is not readily discoverable through reverse engineering.

However, even if chemical identity information can be legally withheld from the public, section 323 provides for disclosure of this information to health professionals who need the information for diagnostic and treatment purposes or local health officials who need the information for prevention and treatment activities. In non-emergency cases, the health professional receiving the information must sign a confidentiality agreement with the facility and provide a written statement of need. In medical emergency situations, the health professional must, if requested by the facility, provide these documents as soon as circumstances permit.

Information claimed as a trade secret and substantiation for that claim must be submitted to EPA. More detailed information on the procedure for submitting trade secrecy claims can be found in the trade secrets final rule, published in the Federal Register, July 29, 1988 (40 CFR 350). Any person may challenge trade secret claims by petitioning EPA. The Agency must then review the claim and rule on its validity.

The trade secret regulations cover the process for submission of claims, petitions for disclosure, and the review process for petitions.

### SARA Title III Penalties

Section 325 of the Emergency Planning and Community Right-to-Know Act addresses the penalties for failure to comply with the requirements of this law. Civil and administrative penalties ranging up to $10,000-$75,000 per violation or per day per violation can be assessed to facilities that fail to comply with the emergency planning (section 302), emergency notification (section 304), Community Right-to-Know (sections 311 and 312), toxic chemical release (section 313), and trade secret (Sections 322 and 323) reporting requirements.

Criminal penalties up to $50,000 or five years in prison may also be given to any person who knowingly and willfully fails to provide emergency release notification. Penalties of not more than $20,000 and/or up to one year in prison may be given to any person who knowingly and willfully discloses any information entitled to protection as a trade secret. In addition, section 326 allows citizens to initiate civil actions against EPA, state emergency response commissions, and/or the owner or operator of a facility for failure to meet the requirements of the emergency planning and Community Right-to-Know provisions. A state emergency response commission, local emergency planning committee, state or local government may institute actions against facility owner/operators for failure to comply with Title III requirements. In addition, states may sue EPA for failure to provide trade secret information.

### Training Grants

Section 305(a) of the Emergency Planning and Community Right-to-Know Act authorized the

Federal Emergency Management Agency to provide $5 million for each of fiscal years 1987, 1988, 1989, and 1990 for training grants to support state and local governments. These training grants continue to be funded past 1990. These training grants are designed to improve emergency planning, preparedness, mitigation, response, and recovery capabilities. Such programs must provide special emphasis to hazardous chemical emergencies. The training grants may not exceed 80 percent of the cost of any such programs. The remaining 20 percent must come from non-federal sources. These training grants are coordinated within each state by the state emergency response commission.

## Public Access

Section 324 of the Emergency Planning and Community Right-to-Know Act provides for public access to information gathered under this law. Under this section, all material safety data sheets, hazardous chemical inventory forms, toxic chemical release inventory forms, toxic chemical release form follow-up emergency notices, and the emergency response plan must be made available during normal working hours by the SERC and LEPC. In order to inform the public of the availability and location of the information provided to the LEPC, the LEPC must publish a notice annually in the local newspaper.

In addition, Toxic Release Inventory (Section 313) information collected by EPA is available by telecommunications and other means. This information can be accessed through a variety of sources. Each year, EPA releases a printed report summarizing the information that was submitted for the annual Toxic Release Inventory. A computerized on-line database of the Toxic Release Inventory data is available through the National Library of Medicine's TOXNET on-line system 24 hours a day. The complete Toxic Release Inventory on magnetic tape is available from the National Technical Information Service (NTIS) and the Government Printing Office (GPO). The 1987 TRI and pertinent Hazardous Substance Fact Sheets containing reference material on the health and ecological effects of the regulated substances is available on CD-ROM from both NTIS and GPO. Also available through NTIS and GPO are floppy diskettes containing state specific Toxic Release Inventory information. Interested parties may view the 1987 Toxic Release Inventory data on microfiche at selected Federal Depository and public libraries. The list of libraries is also available from NTIS and GPO. Both state and national sets of microfiche can also be purchased from NTIS and GPO. Most of these products are updated on an annual basis; therefore be sure to indicate which year's TRI data you would like.

For general information contact the Emergency Planning and Community Right-to-Know Information Hotline:

Hotline: 1-800-535-0202 (TDD number for the hearing impaired: 703-553-7672)

Hours: 8:30 am - 7:30 pm (Eastern Time)
Monday -Friday

This is NOT an emergency number

For on-line access to the Toxic Release Inventory on TOXNET, call:

National Library of Medicine
Specialized Information Service
(301) 496-6531

## Related Legislation

The Oil Pollution Act (OPA) of 1990 includes national planning and preparedness provisions for oil spills that are similar to SARA Title III provisions for extremely hazardous substances. Plans are to be developed at the local, State and federal levels. The OPA offers an opportunity for LEPCs to coordinate their Title III plans with area and facility oil spill plans covering the same geographical area.

The Hazardous Materials Transportation Uniform Safety Act (HMTUSA) includes funding grants to States for planning and hazmat training, as well as requiring the development of a national curriculum for training for responders. States must certify that they are complying with SARA Title III sections 301 and 303, and must pass through at least 75 percent of their planning grant directly to LEPCs; training grants to States and Indian tribes are to be used for training public sector employees in hazmat response and 75% of the training grant money must go to benefit the local responders.

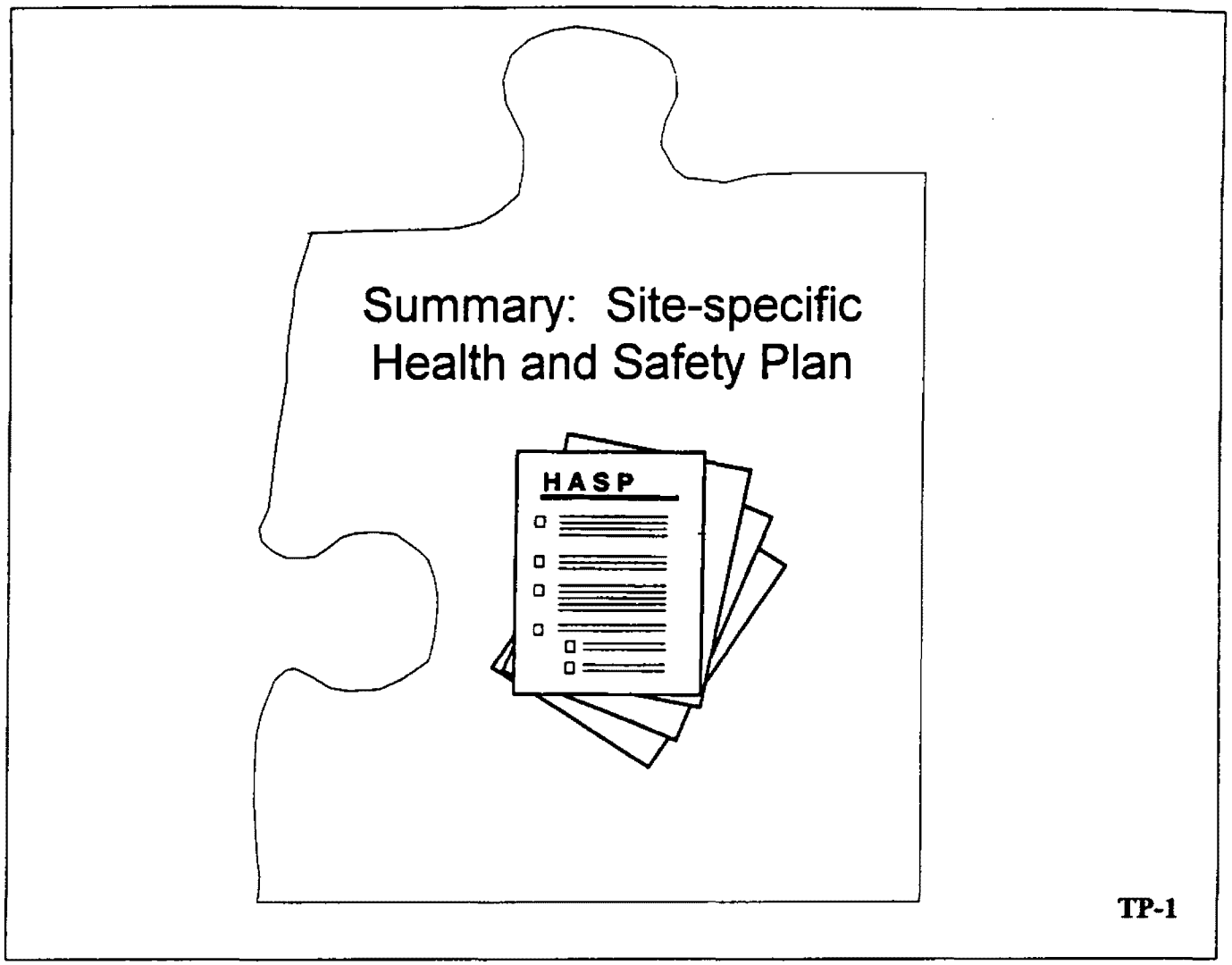
The Clean Air Act Amendments require the EPA and the Occupational Safety and Health Administration (OSHA) to develop regulations for chemical safety management. Facilities that have certain chemicals above specified threshold quantities will be required to develop a system to identify and evaluate hazards and manage those hazards safely. Information facilities develop on their hazards must be submitted to States and local emergency planners and available to the public.

The Pollution Prevention Act represents a fundamental shift in the traditional approach to pollution control. Instead of concentrating on the treatment and disposal of wastes, it focuses on source reduction. Specific provisions affect section 313 reporting and are described above.

## Chemical Lists Associated With Emergency Planning and Community Right-to-Know

| List | Section | Purpose |
|---|---|---|
| List of Extremely Hazardous Substances (40 CFR 355) | §302: Emergency Planning<br>§304: Emergency Notification<br>§311/312: Material Safety Data Sheets and Emergency Inventory | • Facilities with more than threshold planning quantities of these substances must notify the SERC and LEPC.<br>• Initial focus for preparation of emergency plans by local emergency planning committees.<br>• Certain releases of these substances in excess of the reportable quantity (RQ) trigger section 304 notification to SERC and LEPC.<br>• Separate and lower thresholds are established for these substances of concern for the MSDS and Tier I/II (section 311/312) reporting requirements. |
| Substances requiring notification under Section 103 (a) of CERCLA (40 CFR 302.4) | §304: Emergency Notification | • Certain releases of these substances in excess of the RQ trigger section 304 notification to SERC *and* LEPC as well as section 103(a) requirements for National Response Center notification. |
| Hazardous Chemicals considered physical or health hazards under OSHAs Hazard Communication Standard (29 CFR 1910, 1200) (This is a performance standard; there is no list of chemicals.) | §304: Emergency Notification<br>§311: Material Safety Data Sheets<br>§312: Emergency and Hazardous Chemical Inventory | • Identifies facilities subject to emergency notification requirements.<br>• MSDS or list of MSDS chemicals provided by covered facilities to SERC, LEPC and local fire departments.<br>• Tier I/II hazardous chemical inventory forms must be provided by facilities to SERC, LEPC and local fire departments. |
| Toxic Chemicals (More than 300 chemicals and categories) (40 CFR 372) | §313: Toxic Chemical Release Reporting | • These chemicals are reported on a Toxic Release Inventory to inform government officials and the public about the release of toxic chemicals into the environment. |

# SUMMARY: SITE-SPECIFIC HEALTH AND SAFETY PLAN




## *Module Goal:*

The student goal for this module is:

Given presented material and the components of a site-specific health and safety plan (HASP), determine how the components relate to one another.

Given presented material, list the components of a site-specific HASP.

## Eleven Components of a HASP

HASP

- Key personnel
- Health and safety risk analysis
- Site control measures
- Training assignments
- Medical surveillance requirements
- Personal protective equipment
- Air and employee monitoring
- Spill containment program
- Confined space procedures
- Decontamination procedures
- Emergency response plan

TP-2

Given presented material, order the components of a site-specific HASP sequentially.

## Eleven Components of a HASP (cont.)

HASP

- Key personnel
- **Health and safety risk analysis**
- Site control measures
- **Training assignments**
- **Medical surveillance requirements**
- **Personal protective equipment**
- **Air and employee monitoring**
- **Spill containment program**
- **Confined space procedures**
- Decontamination procedures
- **Emergency response plan**

TP-3

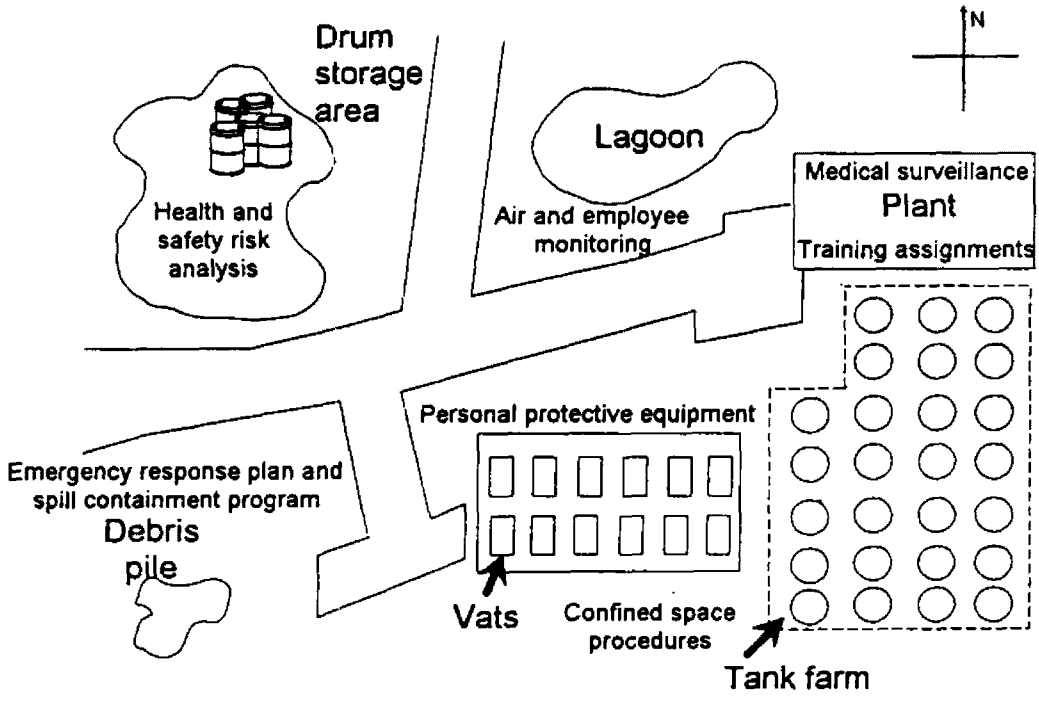
# Eleven Components of a HASP (cont.)

HASP

- **Key personnel**
- Health and safety risk analysis
- **Site control measures**
- Training assignments
- Medical surveillance requirements
- Personal protective equipment
- Air and employee monitoring
- Spill containment program
- Confined space procedures
- **Decontamination procedures**
- Emergency response plan

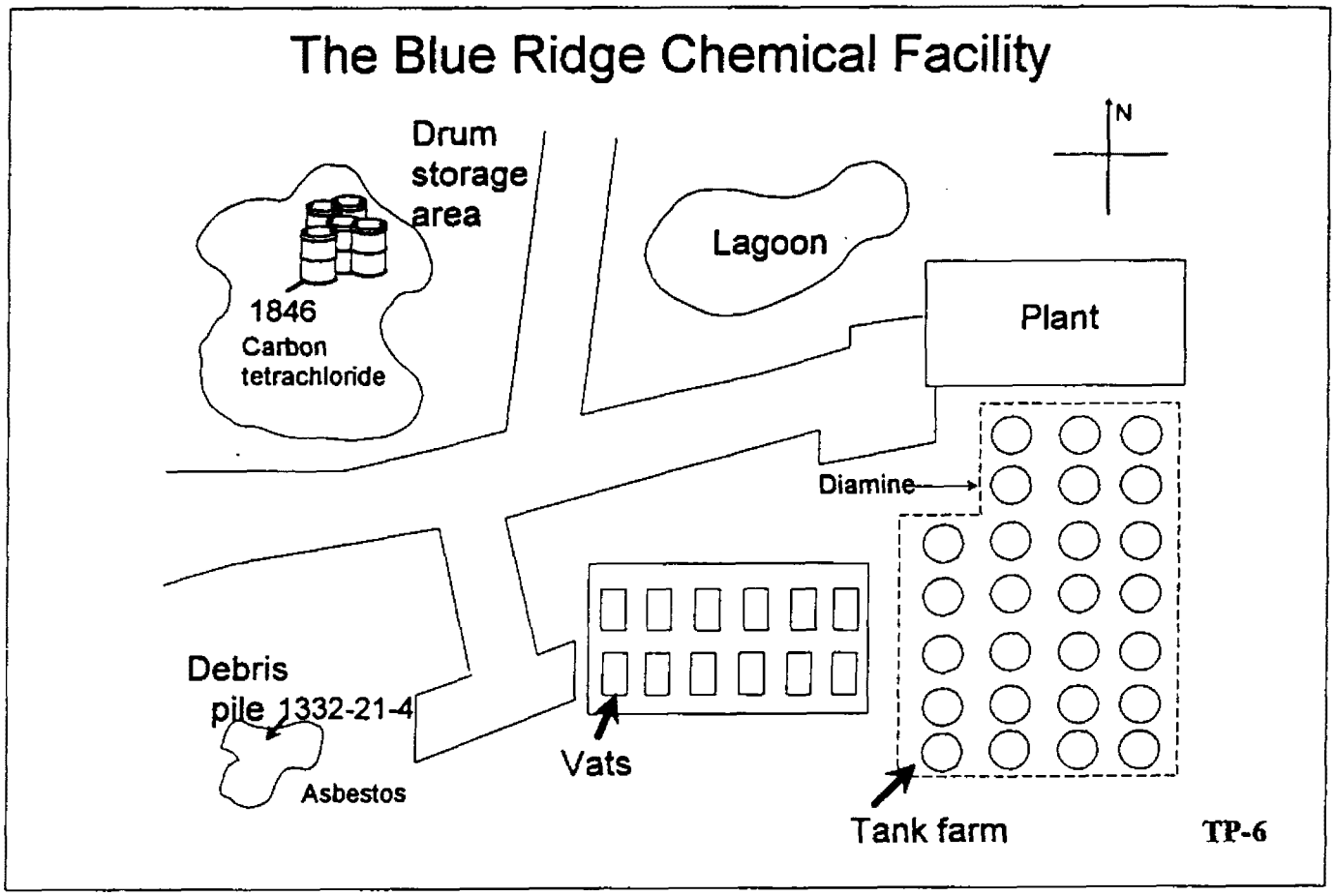
**TP-4**

# Case Study Review:
# The Blue Ridge Chemical Facility




TP-5

Given presented material and conditions that exist at a hypothetical hazardous waste site, develop the sections needed to complete a HASP.




1. Key Personnel
   Develop an organizational structure for a site inspection of the drum storage area.

2. Site Control Measures
   A. Diagram the three work zones needed to conduct an inspection of the lagoon.
   B. Develop two work practices for taking samples from the lagoon.

3. Decontamination Procedures
   Determine the level of protection that would be needed for decontamination workers if a site inspection were conducted at the debris pile and the tank farm simultaneously.

4. Visitor Policy
   Develop policies for occasional onsite workers, media, and local, state, and other VIPs.

## Conclusion

**HASP**

- Key personnel
- Health and safety risk analysis
- Site control measures
- Training assignments
- Medical surveillance requirements
- Personal protective equipment
- Air and employee monitoring
- Spill containment program
- Confined space procedures
- Decontamination procedures
- Emergency response plan

TP-7

## Crossword Puzzle

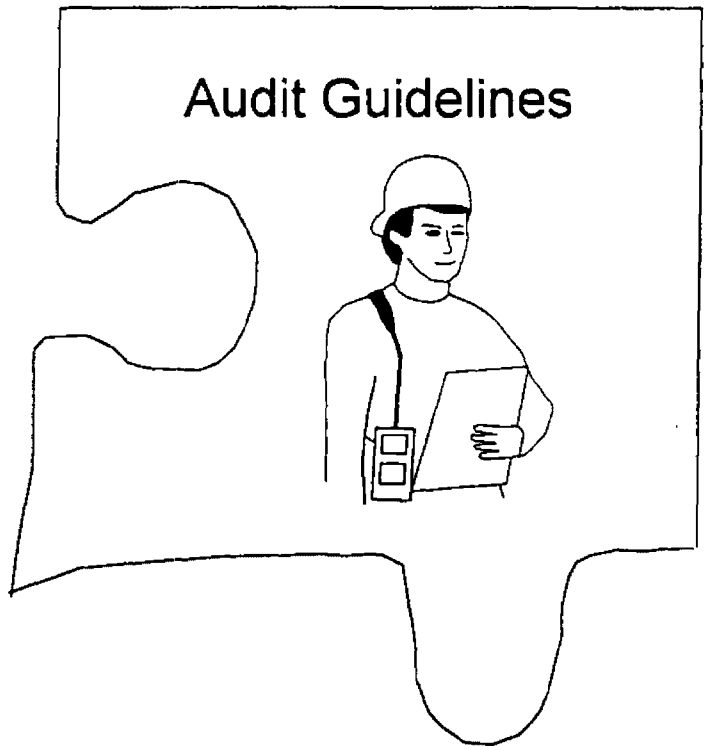
**Across**

4. One of the goals of a spill containment plan is to _____ the spread of contamination
18. The HASP has _____ components

**Down**

9. The HASP requires the designation of a site safety _____
28. Site control measures include the "_____ system"

# AUDIT GUIDELINES




TP-1

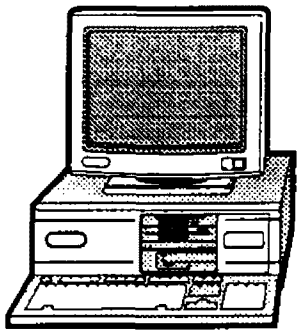
## *Module Goal:*

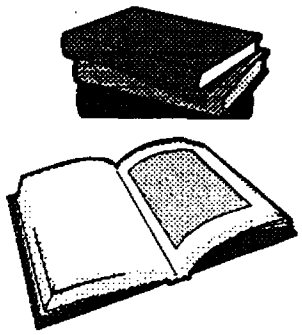
The student goal for this module is:

Given health and safety plans (HASPs) and the U.S. Environmental Protection Agency (EPA) Health and Safety Audit Guidelines document, perform an audit in accordance with the EPA Audit Guidelines.

Given a selected chapter of the EPA Health and Safety Audit Guidelines, match the sections of the chapter to the corresponding sections of a HASP.

## Preliminary Evaluation





TP-2

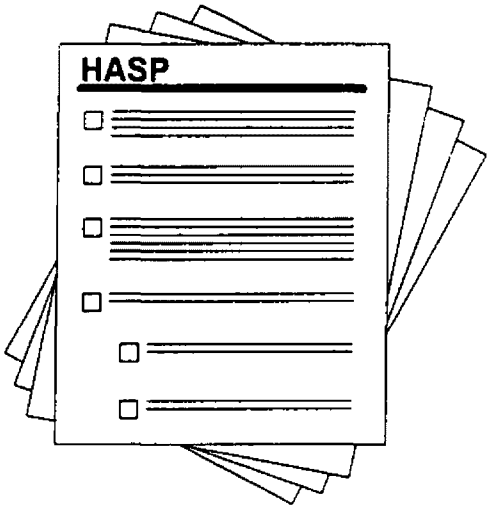
### Essential Components of a Preliminary Evaluation

A preliminary evaluation (PE) is instrumental in developing a HASP that tailors protective measures to site-specific hazards that employees may face.

The following eight components are required in the preliminary evaluation:

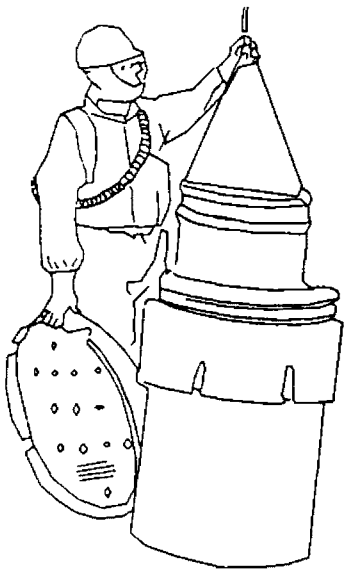
1. Site location and size.
2. Description of offsite emergency response and onsite job functions.
3. Planned duration of employee activity.
4. Site topography and site accessibility by air and roads.
5. Safety and health hazards expected at the site.
6. Pathways for hazardous substance dispersion.
7. Present status of emergency response teams for onsite emergencies.
8. Hazardous substances and health hazards present or expected at the site and their chemical and physical properties.

## Chapter 3
## Written Health and Safety Plan




## Chapter 4
## Health and Safety Field Review

## Chapter 5
## Off-site Emergency Response Review



TP-3

Environmental Response Training Program
Audit Guidelines 1995

EPA

## Table of Contents


Appendix A ..... Acronyms

Appendix B ..... Other OSHA Standards

Appendix C ..... Safety Check Off List

Appendix D ..... Levels of Personal Protection

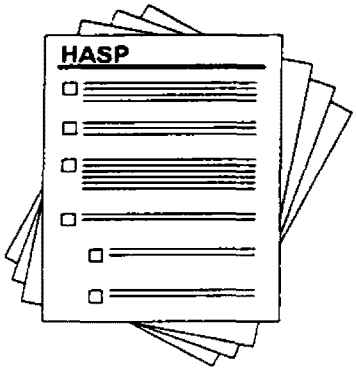
Appendix E ..... Generic HASP

Appendix F ..... OSHA Form No. 200

Appendix G ..... Bibliography


**TP-4**

Given selected sections of the EPA Health and Safety Audit Guidelines that correspond to a HASP, determine deficiencies in the plan by answering Audit Guidelines questions.




## Site-specific Health and Safety Plan Exercise

Audit the following health and safety plan using the worksheets, which are taken from Chapter 3 of the Audit Guidelines document. If you answer "no" to a question, provide an explanation in the blanks provided.

# Site-specific Health and Safety Plan

## Site Description

The Johnson Ceramics site is located on Prairie Meadow Road in Falls Creek, Beaver County, Indiana. The plant is an abandoned china-producing facility containing a lead-contaminated ceramic residue. This contaminated residue was discharged from the ceramic facility into a small stream which fed into a settling lagoon. The lagoon discharges into an overflow culvert beneath a Conrail track line that leads to a wetland area.

## Names of Key Personnel and Health and Safety Personnel

The following personnel and organizations are critical to the planned activities at the Johnson Ceramics site:

| | |
|---|---|
| U.S. EPA On-scene Coordinator | Jack Downs |
| Prime ERCS Contractor | A.J. Environmental |
| Response Manager | Fred Parker |
| Site Health and Safety Officer | Ralph McDonald |

## Task/Risk Analysis

Task 1 - Site walk-through assessment
Task 2 - Sampling onsite (soils and lagoons)
Task 3 - Sampling offsite (stream and wetland)
Task 4 - Excavation of contaminated soil
Task 5 - Lagoon solidification

| Task | Contaminant | PEL/TLV/IDLH | Source Concentration (onsite) | Route of Exposure | Symptoms of Acute Exposure | Monitoring Device |
|---|---|---|---|---|---|---|
| 1-5 | Lead | 0.05 mg/m$^3$<br>0.15 mg/m$^3$<br>100 mg/m$^3$ | soil, air, waste | Inh, Ing, Con | weak, insom, low wt, anemia, abdom pain, tremor, kidney dis, irrit eyes, hypotension | X-ray fluores |

# Task Risk Analysis: Physical Hazard Assessment

| | | HAZARD (Y/N) | TASK No(s). | PREVENTION |
|---|---|---|---|---|
| 1. | Noise | ( Y ) | 4, 5 | hearing protection |
| 2. | Heat - Ambient air | ( ) | | |
| | - Hot process - steam | ( ) | | |
| | - Hot process - incinerator | ( ) | | |
| 3. | Cold | ( ) | | |
| 4. | Rain | ( ) | | |
| 5. | Snow | ( ) | | |
| 6. | Electric storms | ( ) | | |
| 7. | Confined space entry | ( ) | | |
| 8. | "Hot Work" | ( ) | | |
| 9. | Heavy manual lifting/moving | ( ) | | |
| 10. | Rough terrain | ( ) | | |
| 11. | Housekeeping | ( ) | | |
| 12. | Structural integrity | ( ) | | |
| 13. | Neighborhood | ( ) | | |
| 14. | Remote area | ( ) | | |
| 15. | Compressed gas | ( ) | | |
| 16. | Diving | ( ) | | |
| 17. | Using boats | ( ) | | |
| 18. | Working over water | ( Y ) | 2, 3, 5 | buddy system |
| 19. | Traffic | ( ) | | |
| 20. | Explosives | ( ) | | |
| 21. | Heavy equipment operation | ( Y ) | 4, 5 | |
| 22. | Lifting equipment operation - Crane | ( ) | | |
| 23. | - Manlifts | ( ) | | |
| 24. | Working at elevation | ( ) | | |
| 25. | Using ladders | ( ) | | |
| 26. | Using scaffolding | ( ) | | |
| 27. | Excavating/trenching | ( Y ) | 4 | |
| 28. | Materials handling | ( ) | | |
| 29. | Hazardous materials use/storage - Flammable liquids | ( ) | | |
| | - Oxidizers | ( ) | | |
| | - Corrosives | ( ) | | |
| 30. | Fire prevention/response plan required | ( ) | | |
| 31. | Fire extinguishers required | ( ) | | |
| 32. | Demolition | ( ) | | |
| 33. | Utilities - Underground | ( ) | | |
| | - Overhead | ( ) | | |
| 34. | Electrical - General | ( ) | | |
| | - High voltage | ( ) | | |
| 35. | Welding/cutting/burning | ( ) | | |
| 36. | Hand tools | ( ) | | |
| 37. | Power hand tools | ( ) | | |
| 38. | High pressure water | ( ) | | |

**Employee Training**

At a minimum, all personnel will be trained to recognize the hazards onsite, the provisions of this site-specific HASP, and personnel responsible for safety at the site.

# Worksheets

Taken from Chapter 3,
Written Health and Safety Plan,
*Health and Safety Audit Guidelines*

The HASP elements in the box to the right do not appear in the same order as provided in 29 CFR 1910.120(b). Instead, these elements are arranged in the order in which their associated relevant paragraphs appear within 29 CFR 1910.120.

This checklist portion of the EPA Audit Guidelines permits the user to identify inadequacies in the HASP. Answers to the HASP checklist questions should be ascertainable by reviewing the HASP.

At a minimum the HASP should contain the following information:

- Names of key personnel responsible for site safety;
- Safety and health risk analyses for each site task and operation;
- Site control measures;
- Employee training arrangements;
- Medical surveillance requirements;
- Personal protective equipment for each of the site tasks and operations;
- Frequency and types of air monitoring, personnel monitoring, environmental sampling techniques and instrumentation along with methods for maintenance and calibration of equipment;
- Confined space entry procedures;
- Spill Containment Program;
- Decontamination procedures; and
- Emergency response plan.

3.1 Names of Key Personnel and Health and Safety Personnel - 29 CFR 1910.120(b)(2)

Key personnel may include individuals with job titles such as Project Manager, Field Operations Leader, and Site Supervisor. A Site Health and Safety Officer should also be designated and always be onsite during operations.

3.1.1 Are key personnel identified in the HASP?

[YES] [NO, EXPLAIN]

_____

_____

_____

3.1.2 Are the health and safety personnel (including alternates) identified in the HASP?

[YES] [NO, EXPLAIN]

_____

_____

_____

Note: During the field audit, verify key site personnel and the presence of the site health and safety officer.

3.1.3 _____

_____

_____

3.1.4 _____

_____

_____

SUMMARY OF RESPONSES [YES] _____ [NO, EXPLAIN] _____

3.2 Safety and Health Risk Analysis for Each Site Task and Operation - 29 CFR 1910.120(b)(4)

Simple risk analyses can be conducted based on the chemical contaminants of concern, the affected media, concentrations, and potential routes of exposure. These elements are essential to any analysis of health risks. OSHA-PELs and IDLH levels should be provided at a minimum for compounds, which have the potential to become airborne. These values can be located for many compounds in the NIOSH/ OSHA Pocket Guide to Chemical Hazards, 1985, as well as in 29 CFR 1910.1000 as published on January 19, 1989 (FR Vol. 54, No. 12).

The HASP also should incorporate some safety risk analyses to address anticipated onsite operations. Certain field operations may be less safe when conducted at a hazardous waste site than if conducted in a more conventional environment. In addition, certain jobs at a hazardous waste site differ in their potential hazards. For instance, the job of a heavy equipment operator or materials handler would generally be a more hazardous job than the job of a supervisor because of the increased risk of direct contact with the concentrated waste. Methods and procedures for reducing safety hazards should be provided in the HASP.

The EPA Superfund Public Health Evaluation Manual (1986), may be useful to users as a tool for performing more sophisticated health risk analyses attributable to common chemical contaminants found at hazardous waste sites. The Guidelines enable the user to calculate hazard indices for chemicals without carcinogenic potential, and to calculate the likely increase in cancer incidence rates associated with exposure to carcinogens at the hazardous waste site.

3.2.1 Does the HASP address methods to deal with potential safety problems (e.g., heavy equipment operations, presence of live electrical sources, and slip, trip, fall hazards)?

[YES] [NO, EXPLAIN]

_____

_____

_____

3.2.2 Does the HASP contain a safety and health risk or hazards analysis for each site task and operation found in the workplan?

[YES] [NO, EXPLAIN]

_____

_____

_____

Note: Verification of incorporation into the HASP of health and safety risk analysis for each site task and operation occurring in the field should be determined during the field audit.

3.2.3 Are chemical contaminants, affected media, concentrations, potential routes of exposure, and health effects identified in the HASP?

[YES] [NO, EXPLAIN]

_____

_____

_____

3.2.4 Does the HASP identify the appropriate PPE level for each site task and operation?

[YES] [NO, EXPLAIN]

_____

_____

_____

3.2.5 _____

_____

_____

3.2.6 _____

_____

_____

SUMMARY OF RESPONSES [YES] _____ [NO, EXPLAIN] _____

3.4 Employee Training - 29 CFR 1910.120(e)

The employee's initial health and safety training, annual health and safety refresher training, on-the-job training, supervisory training (where applicable), first-aid training, CPR training, and other training relevant to the performance of hazardous waste site operations should be indicated in the HASP for all individuals involved in onsite activities.

3.4.1 Does the HASP indicate that all onsite employees meet appropriate health and safety training requirements?

[YES] [NO, EXPLAIN]

_____

_____

_____

If NO, please go on to questions 2-5, while if YES please go on to question 6.

3.4.2 Does the HASP indicate that all individuals expected to be onsite have the requisite initial health and safety training?

[YES] [NO, EXPLAIN]

_____

3.4.3 Does the HASP indicate that individuals functioning in a supervisory capacity have the requisite supervisory training?

[YES] [NO, EXPLAIN]

_____

_____

_____

3.4.4 Does the HASP indicate that all individuals functioning independently of an immediate supervisor have a minimum of three days of actual field experience under a skilled supervisor (on-the-job training)?

[YES] [NO, EXPLAIN]

_____

_____

_____

3.4.5 Does the HASP indicate that all individuals who had their initial health and safety training longer than one year ago have also completed the required annual health and safety refresher training?

[YES] [NO, EXPLAIN]

_____

_____

_____

3.4.6 Does the HASP indicate that employees have had training to recognize the symptoms and signs of overexposure to chemical hazards?

[YES] [NO, EXPLAIN]

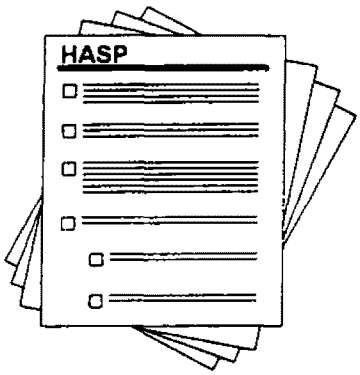
_____

_____

_____

SUMMARY OF RESPONSES [YES] _____ [NO, EXPLAIN] _____

## Case Study Exercise




Audit the following health and safety plan using the worksheets, which are taken from Chapter 3 of the Audit Guidelines document. If you answer "no" to a question, provide an explanation in the blanks provided.

Once all the groups have finished, the instructor will ask for a volunteer from each group to present group responses to various sections. During each group presentation, the instructor will ask for additional comments from the remaining groups.

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Rev. no.: 2

Safety Plan No.: J007 - 11 Site Name: Chandler Gas Works

**ABC Environmental**

**SITE SAFETY PLAN**

Site Address: 10th Street between Main and Cedar Streets
Chandler, NJ 08888

Site Contact: Gary Mon (PSE&G)
Phone Number: (411) 430-7822
Other Contacts: Robert Bobbet (PSE&G)
(800) 762-2449

Purpose of Site Visit: Conduct onsite and offsite reconnaissance
Proposed Date of Work: 10/23/94

Proposed Site Investigation Team:

| ABC Environmental Personnel: | Responsibilities: |
|---|---|
| Bob Carry | Site Manager |
| Dick Trophy | Site Safety Officer |
| Christine Sacks | Surveillance |

| Other: | Purpose: |
|---|---|
| | |

**Plan Preparation**

| | | Date |
|---|---|---|
| Prepared by: | Christine Sacks | 10/10/94 |
| Approvals: | | |
| Health and Safety Manager: | Charles V. Blum | 10/05/94 |
| Office Manager: | Don Mann | 10/10/94 |

Safety Plan No.: J007 - 11 Site Name: Chandler Gas Works

**Background Information:**

Site Status: _____ Active X Inactive _____ Unknown

Site Description (be specific; include topography, structures, size, etc.):

**The site is generally level and is currently a suburban residential neighborhood. No evidence of former gas works is apparent.**

Site History:

**The Chandler Gas Works site is located between Main and Cedar Streets on 10th Street in Chandler, NJ. For approximately 11 years (1894-1905) water gas was reportedly manufactured at the site. Public service Gas Company leased the site prior to 1905. Activities preceding its current use are unknown. Presently the site has residential dwellings built atop of it. Five residential lots appear to be involved with homes built during the early 1950s based on ownership records.**

Monitoring used on previous site work or previous sampling data (include dates and by whom work was done):

**NJDEPE has groundwater and soil (surface and borings) data at the site. This information has not yet been made available to ABC Environmental personnel.**

Safety Plan No.: J007 - 11 Site Name: Chandler Gas Works

Hazard Evaluation:

Waste Types:

| | | | |
|---|---|---|---|
| ____ Liquid | ✓ Solid | ✓ Sludge | ____ Vapor |
| ____ Corrosive | ____ Ignitable | ____ Radioactive | |
| ✓ Volatile | ✓ Toxic | ____ Reactive | |
| ____ Unknown | ____ Other: | | |

Hazard Identification/Ranking (based on task and contaminant).

Task: Onsite reconnaissance ✓ Low ____ Medium ____ High

Identification of Hazards (chemical and physical):

**The site now has residential properties; therefore, there is little likelihood of coming into contact with any wastes or physical hazards.**

Task: Offsite reconnaissance ✓ Low ____ Medium ____ High

Identification of Hazards (chemical and physical):

**The character of the general area has been changed; therefore, there is little likelihood of coming into contact with any chemical hazards. The physical hazard of greatest concern is moving traffic on city streets.**

Task: ____ ____ Low ____ Medium ____ High

Identification of Hazards (chemical and physical):

Hazard Assessment: **Use of air instruments and proper PPE should eliminate any hazard threat.**

**OVERALL HAZARD:** ____ Serious ____ Moderate ✓ Low ____ Unknown

Safety Plan No.: J007 - 11 Site Name: Chandler Gas Works

Make sure units are the same. ppm = $\frac{mg/m^3 \times 24.45}{\text{molecular weight}}$ = $\frac{mg/L \times 24,500}{\text{molecular weight}}$

| Hazardous/Toxic Known or Suspected Materials | Concentration* | Media Soil, Sediment, Surface water or Groundwater | Toxic and Pharmacologic Effects | Ionization Potential (IP), or Vapor Pressure (VP) in air | *PELs, TLVs, IDLH | If concentration > 10 ppm in Media, use NFPA Guidance for Flammability, Reactivity, and Special Notice | Applicable Monitoring Instruments for Health and Safety Screening |
|---|---|---|---|---|---|---|---|
| Ammonia<br>CAS No. 7664-41-7 | unknown | soil | poison, eye and mucus membranes, systemic irritant | 10.15 ev | PEL: 35 ppm<br>TLV: 25 ppm<br>IDLH: 300 ppm | Flammability: 1<br>Reactivity: 0<br>Special Notice: | HNu |
| Sulfur<br>CAS No. 7704-34-9 | unknown | soil | eye irritant, mucus membrane irritant through inhalation | | PEL:<br>TLV:<br>IDLH: | Flammability: 1<br>Reactivity: 0<br>Special Notice: | |
| Cyanides<br>CAS No. 151-50-8 | unknown | soil | poison, inhalation, ingestion, affects heart and resp. systems | | PEL: 5 mg/m³<br>TLV: 5 mg/m³<br>IDLH: 50 mg/m³ | Flammability:<br>Reactivity:<br>Special Notice: | |
| Phenols<br>CAS No. 108-95-2 | unknown | soil | carcinogen, eye/ skin irritant, easily absorbed by skin | 8.69 ev | PEL: 5 ppm<br>TLV: 5 ppm<br>IDLH: 250 ppm | Flammability: 2<br>Reactivity: 0<br>Special Notice: | HNu<br>OVA |
| Anthracene<br>CAS No. 120-12-7 | unknown | soil | carcinogen, skin irritant and allergen | | PEL:<br>TLV:<br>IDLH: | Flammability:<br>Reactivity:<br>Special Notice: | |
| Napthalene<br>CAS No. 91-20-3 | unknown | soil | eye/skin irritant, poison, liver damage, coma | | PEL: 10 ppm<br>TLV: 10 ppm<br>IDLH: 250 ppm | Flammability: 2<br>Reactivity: 0<br>Special Notice: | OVA |
| Pyrene<br>CAS No. 129-00-0 | unknown | soil | carcinogen, skin irritant | | PEL:<br>TLV:<br>IDLH: | Flammability:<br>Reactivity:<br>Special Notice: | |

SHOMFM Audit Guidelines

Safety Plan No.: J007 - 11 Site Name: Chandler Gas Works

Make sure units are the same. ppm = $\frac{mg/m^3 \times 24.45}{\text{molecular weight}}$ = $\frac{mg/L \times 24{,}500}{\text{molecular weight}}$

| Hazardous/Toxic Known or Suspected Materials | Concentration* | Media Soil, Sediment, Surface water or Groundwater | Toxic and Pharmacologic Effects | Ionization Potential (IP), or Vapor Pressure (VP) in air | *PELs, TLVs, IDLH | If concentration > 10 ppm in Media, use NFPA Guidance for Flammability, Reactivity, and Special Notice | Applicable Monitoring Instruments for Health and Safety Screening |
|---|---|---|---|---|---|---|---|
| Benzene<br>CAS No 71-43-2 | unknown | soil | carcinogen, poison, eye/skin irritant, affects CNS and blood | 9.25 ev | PEL: 1 ppm<br>TLV: 0.1 ppm<br>IDLH: 500 ppm | Flammability: 3<br>Reactivity: 0<br>Special Notice: | HNu<br>OVA |
| Toluene<br>CAS No 108-88-3 | unknown | soil | poison, mutagen, skin/eye irritant, CNS psychotrophic effects | 8.82 ev | PEL: 200 ppm<br>TLV: 100 ppm<br>IDLH: 500 ppm | Flammability: 3<br>Reactivity: 0<br>Special Notice: | OVA<br>HNu |
| Cadmium<br>CAS No 7440-43-9 | unknown | soil | poison, inhalation hazard | | PEL: 0.01 mg/m³<br>TLV: 0.05 mg/m³<br>IDLH: 40 mg/m³ | Flammability:<br>Reactivity:<br>Special Notice: | |
| Lead<br>CAS No 7439-92-1 | unknown | soil | affects CNS, lungs, and kidneys | | PEL: 0.050 mg/m³<br>TLV: .100 mg/m³<br>IDLH: 100 mg/m³ | Flammability:<br>Reactivity:<br>Special Notice: | |
| Manganese<br>CAS No 7439-96-5 | unknown | soil | | | PEL: 5 mg/m³<br>TLV: 1 mg/m³<br>IDLH: 500 mg/m³ | Flammability:<br>Reactivity:<br>Special Notice: | |
| CAS No | | | | | PEL:<br>TLV:<br>IDLH: | Flammability:<br>Reactivity:<br>Special Notice: | |
| CAS No | | | | | PEL:<br>TLV:<br>IDLH: | Flammability:<br>Reactivity:<br>Special Notice: | |

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Safety Plan No.: J007 - 11

Site Name: Chandler Gas Works

## REQUIRED LEVEL(S) OF PROTECTION

| Task | Name | Respiratory | Clothing | Gloves | Boots | Other; Modifications |
|---|---|---|---|---|---|---|
| SM | Bob Carry | B/C/D | T/F | L | L | *Level C will be used during dry, |
| SSO | Dick Trophy | B/C/D | T/F | L | L | dusty conditions. |
| SMO | | | | | | |
| Surveillance | Christine Sacks | B/C/D | T/F | L | L | **Level B will be used if readings |
| | | | | | | above background are detected. |
| Samplers | | | | | | ***Given the present condition of |
| | | | | | | the site, the lowest level of PPE |
| | | | | | | should be used depending on field |
| | | | | | | observations. |
| Samplers | | | | | | |
| Decon | | | | | | |
| Other | | | | | | |

Tyvek = T
Saranex = S
Field = F
Chemrel = C

Latex = L
Neoprene = Ne
Viton = V
Butyl = B
PVA = A
Nitrile = Ni
PVC = C

Fireman's = F
Tyvek cover = C
Latex overboot = L
Butyl overboot = B
Neoprene overboot = N

Other:
Faceshield
Safety glasses
Butyl apron
Waders

Safety Plan No.: J007 - 11 Site Name: Chandler Gas Works

Summary of Proposed Activities:

**Onsite and offsite reconnaissance of residential neighborhood that occupies the former gas plant site.**

Monitoring Procedures:

Site Monitoring Equipment:

- X HNu
- X OVA
- ____ Photovac
- ____ Draeger Tube(s) & Pump: ____
- ____ Victoreen Radiation Detector
- ____ Other: ____
- X TLD Badge
- X Monitor-4
- ____ Explosimeter
- ____ $O_2$ meter

Methods and Frequency of Surveillance: (For compounds >10% PELs, see page 4)

**Continuous air monitoring using the above throughout the activity onsite. Use of TLD badge for duration of field work activity.**

Monitoring Equipment Calibration:

✓ OVA

Secondary check is required as per Health and Safety SOP prior to each usage. If secondary check is off by more than +10 percent primary a calibration will be performed.

✓ HNu

A single calibration conducted prior to an activity will be considered acceptable for periods of use up to three days, after which calibration gas must be used as per Health and Safety SOP. If the reading deviates more than +15 percent from concentration of the calibration gas, the instrument requires maintenance.

✓ Monitor-4

A battery check and a response check was made with a check source (Coleman mantle) prior to leaving the office and will be made prior to engaging in onsite field activities on a daily basis.

____ Other:

Safety Plan No.: J007 - 11 Site Name: Chandler Gas Works

Decontamination and Disposal:

Personnel Decontamination Procedure: (X) level to be utilized

_____ Level A - Segregated equipment drop, boot cover and glove wash, boot cover and glove rinse, tape removal, outer glove removal, suit and hard hat removal, SCBA backpack removal, inner glove wash, inner glove removal, inner clothing removal, field wash redress.

X Level B - Segregated equipment drop, boot cover and glove wash, boot cover and glove rinse, tape removal, boot cover removal, outer glove removal, SCBA backpack removal, suit and hard hat removal, inner glove removal, inner clothing removal, field wash, redress.

X Level C - Segregated equipment drop, boot cover and glove wash, boot cover and glove rinse, tape removal, boot cover removal, outer glove removal, suit/safety boot wash, suit/safety boot rinse (canister or mask change), safety boot removal, splash suit removal, inner glove removal, inner clothing removal, field wash, redress.

X Level D - Segregated equipment drop, boot and glove wash, and glove rinse.

_____ Modifications (specify): _____

Equipment Decontamination: Alconox/water solution with tap water rinse.

Personal Decontamination: Alconox/water solution with tap water rinse.

Disposal Procedure for Investigation-derived Materials: All aqueous-derived wastes will be disposed of onsite. All dry wastes (decontaminated) will be disposed of offsite.

IONIZING RADIATION: Normal background 0.01 to 0.02 mR/hr.

If less than 2 mR/hr, continue investigation with caution.

If greater than 2 mR/hr, evacuate site.

NOTE: Background 10-20 CPM on Monitor-4.

Safety Plan No.: J007 - 11 Site Name: Chandler Gas Works

## SITE OPERATING PROCEDURES/SAFETY GUIDELINES

1. Always observe the buddy system. Never enter or exit a site alone, and never work alone in an isolated area. Never wander off by yourself.
2. Always maintain line-of-sight.
3. Practice contamination avoidance. Never sit down or kneel, never lay equipment on the ground, avoid obvious sources of contamination such as puddles, and avoid unnecessary contact with onsite objects.
4. No eating, drinking, or smoking outside the designated "clean" zone.
5. In the event PPE is ripped or torn, work shall stop and PPE shall be removed and replaced as soon as possible.
6. Be alert to any unusual changes in your own condition; never ignore warning signs. Notify Health and Safety Coordinator as to suspected exposures or accidents.
7. A vehicle will be readily available exclusively for emergency use. All ABC Environmental personnel going onsite shall be familiar with the most direct route to the nearest hospital.
8. In the event of direct skin contact, the affected area shall be washed immediately with soap and water.
9. Copies of the health and safety plan shall be readily accessible at the command post.
10. Note wind direction. Personnel shall remain upwind whenever possible during onsite activities.
11. Never climb over or under refuse or obstacles. Use safety harness/safety lines when sampling lagoons, stream beds, and ravines with steep banks.
12. Hands and face must be thoroughly washed before eating, drinking, etc.
13. Any modifications to this safety plan MUST be approved by the HSM or designee.

Special Procedures: _____

## OFFSITE SAMPLING ACTIVITIES

Offsite activities delineated within the scope of this Site Safety Plan (SSP) will be conducted:

✓ Yes ____ No

If yes, will it affect any of the following areas: ____ Yes ✓ No

____ Emergency contact information

____ Directions to hospital

____ Decontamination procedures

____ Other: _____

Provide attached pages to describe required modification for offsite activities.

Safety Plan No.: J007 - 11 Site Name: Chandler Gas Works

**Confined Space Entry**

✓ No attempt will be made to enter abandoned buildings, manholes, tanks, or any other confined areas.

_____ Confined space entry will be made into the following:

**Medical Surveillance**

✓ No site-specific medical surveillance is required for this task.

_____ Medical surveillance will be as follows:

**Personnel Monitoring**

✓ Personnel monitoring will include only the use of the TLD badge. No further personnel monitoring is required.

_____ Personnel monitoring will consist of:

ATTACH PERSONNEL TRAINING SHEET TO THIS PAGE

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Safety Plan No.: J007 - 11

Site Name: Chandler Gas Works

## HEALTH AND SAFETY TRAINING

| Employee Name | Superfund Received | CPR Expires | First Aid Expires | SCBA Ref. Expires | Ultra Twin | Dust Resp. | Resp. Maint. Expires | Air Monitor Expires | SSO Training Expires | Decon Received | Medically Cleared | HAZCOM Training Received |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bob Carry | 9/25/87 | 11/05/95 | 11/05/98 | 04/02/95 | YM | N | 08/20/94 | 10/01/94 | 07/20/95 | 10/06/94 | Y | 06/12/94 |
| Dick Trophy | 2/15/91 | 11/05/95 | 11/05/98 | 05/05/94 | YM | N | 08/20/94 | 05/12/95 | 04/05/95 | 10/06/94 | Y | 06/12/94 |
| Christine Sacks | 10/08/84 | 11/05/95 | 11/05/98 | 11/30/95 | Y S | Y | 09/15/95 | 10/01/94 | 07/20/95 | 10/06/94 | Y | 06/12/94 |
| Charles Bunn | 05/24/83 | 11/05/95 | 11/05/98 | 03/12/95 | Y L | Y | 09/15/95 | 05/12/95 | 05/12/95 | 10/06/94 | Y | 06/12/94 |
| Don Mann | 07/15/85 | 11/05/95 | 11/05/98 | 06/06/94 | Y M | Y | 09/15/95 | 05/12/95 | 05/12/94 | 10/06/94 | Y | 06/12/94 |
| Greg Fields | 03/09/90 | 11/05/95 | 11/05/98 | 06/30/95 | Y M | Y | 09/15/95 | 05/12/95 | 03/06/94 | 10/06/94 | Y | 06/12/94 |
| Joe Leads | 04/12/93 | 11/05/95 | 11/05/98 | 08/01/95 | Y S | Y | 09/15/95 | 05/12/95 | 08/12/95 | 10/06/94 | Y | 06/12/94 |

Safety Plan No: J007 - 11 Site Name: Chandler Gas Works

## EMERGENCY SITUATIONS

**Air Releases or Fire/Explosion:**

In the event of an unexpected air release or fire/explosion, onsite personnel will travel at a right angle to the upwind direction. The Site Safety Officer (SSO) will then account for all personnel and notify the proper emergency agencies.

In the event the SSO is unavailable, the Project Manager will assume these responsibilities.

**Emergency Site Control:**

In the event of an emergency, the SSO will discourage any unauthorized personnel from entering the site. If necessary, the SSO will contact the proper authorities.

**Personnel Injury:**

If onsite personnel require emergency medical treatment, the following steps will be taken:

1) Evaluate the nature of the injury.
2) Decontaminate to the extent possible prior to administration of first aid or movement to emergency facilities.

**First Aid Procedures:**

| | |
|---|---|
| Skin Contact: | Remove contaminated clothing. Wash immediately with water. Use soap if available. |
| Inhalation: | Remove victim from contaminated atmosphere. Perform artificial respiration, if necessary. Transport to hospital. |
| Ingestion: | Never induce vomiting on an unconscious person. Also, never induce vomiting when acids, alkalis, or petroleum products are suspected. Contact the poison control center. |
| Equipment Failure: | In the event that the air monitoring equipment fails to operate, all personnel will exit the site immediately and notify the HSM or designee for further instruction. |

Safety Plan No.: J007 - 11 Site Name: Chandler Gas Works

## EMERGENCY SITUATIONS

### Communication Procedures

(Horn blast, siren, etc.) is the emergency signal to indicate that all personnel should leave the Exclusion Zone.

The following standard hand signals will be used in case of failure of radio communications:

| | |
|---|---|
| Hand gripping throat | Out of air, cannot breathe |
| Grip partner's wrist or both hands around waist | Leave area immediately |
| Hands on top of head | Need assistance |
| Thumbs up | OK, I am all right, I understand |
| Thumbs down | No, negative |

### Radio Communication

The following will used on an "as needed" basis:

Channel 1 has been designated as the radio frequency for personnel in the Exclusion Zone. All other onsite communications will use channel 2.

Telephone communication to the Command Post should be established as soon as practicable. The phone number is ( ) **To be determined upon arrival**.

Safety Plan No.: J007 - 11 Site Name: Chandler Gas Works

## EMERGENCY INFORMATION

### LOCAL RESOURCES:

Ambulance (Name): Chandler Fire Department Phone (411) 829-1111
Hospital (Name): Memorial Hospital Phone (411) 835-3480
Police (Local or State): Chandler Phone (411) 829-1211
Fire Dept. (Name and Volunteer): Chandler Phone (411) 829-1111
Radio Channel: 1
Nearest Phone: To be determined upon arrival

### OFFICE RESOURCES:

ABC Environmental: (998) 387-9210
Office Manager: **Ron Drake** Home Phone: **(511) 224-8271**
Health and Safety Manager: **Tony Maloney** Home Phone: **(511) 829-4131**

### EMERGENCY CONTACTS: (Medical and Health)

- (ABC Environmental Consulting Physicians - Hermann Hospital)
  Dr. Britt
  24-Hour Number: **(413) 561-5999**
  Refer to the next page for details on the "Emergency Physician Access Plan"
- Tom Sam (ABC Environmental Health and Safety Manager)
  Office: **(413) 561-4999**
- Regional Health Maintenance Program
  EnviroCare Health Services
  Dr. Bell **(511) 427-0293**
- Poison Information New Jersey (800) 962-1253
  New York (212) 340-4494
  (212) 764-7667

**DIRECTIONS TO HOSPITAL** (Include approximated distance, and attach map).

**Exit site, turn right onto Main Street. Turn right onto Broad Street (County Route 543). Broad Street becomes River Road. Travel approximately 3 miles into Riverside. At Bridgeboro Road, turn right. Go to Clay Street, turn left. Hospital is on left.**

Safety Plan No.: J007 - 11 Site Name: Chandler Gas Works

# EMERGENCY PHYSICIAN ACCESS PLAN
## ABC Environmental
## May, 1993

**A. Monday through Friday, 9:00 a.m. – 5:00 p.m.**

Dial the (413) 888-3111 number. When answered, state that:

(1) You are calling from ABC Environmental;
(2) This is an emergency call.

Program Staff will know how to contact the phys\ician designated to provide emergency coverage on that day. Collect calls will be accepted.

**B. Evenings, weekends, and holidays:**

Dial the (413) 888-3111 number. An operator from the answering service will answer the telephone. Do the following:

(1) Tell the operator that you are calling from ABC Environmental.
(2) Tell the operator that this is an emergency call.
(3) Give the operator your name.
(4) Give the operator the telephone number where the physician is to call. Be certain that the operator has written the correct number (area code and seven digits).
(5) If you do not receive a call back within 15 minutes, place a second call to (413) 888-3111. Collect calls will be accepted.

**C. Situations where employee requires immediate transport to a hospital:**

If the situation is life-threatening, i.e., cardiac arrest or person not breathing, call the emergency medical services system and transport the person to the nearest hospital with advanced life support capabilities.

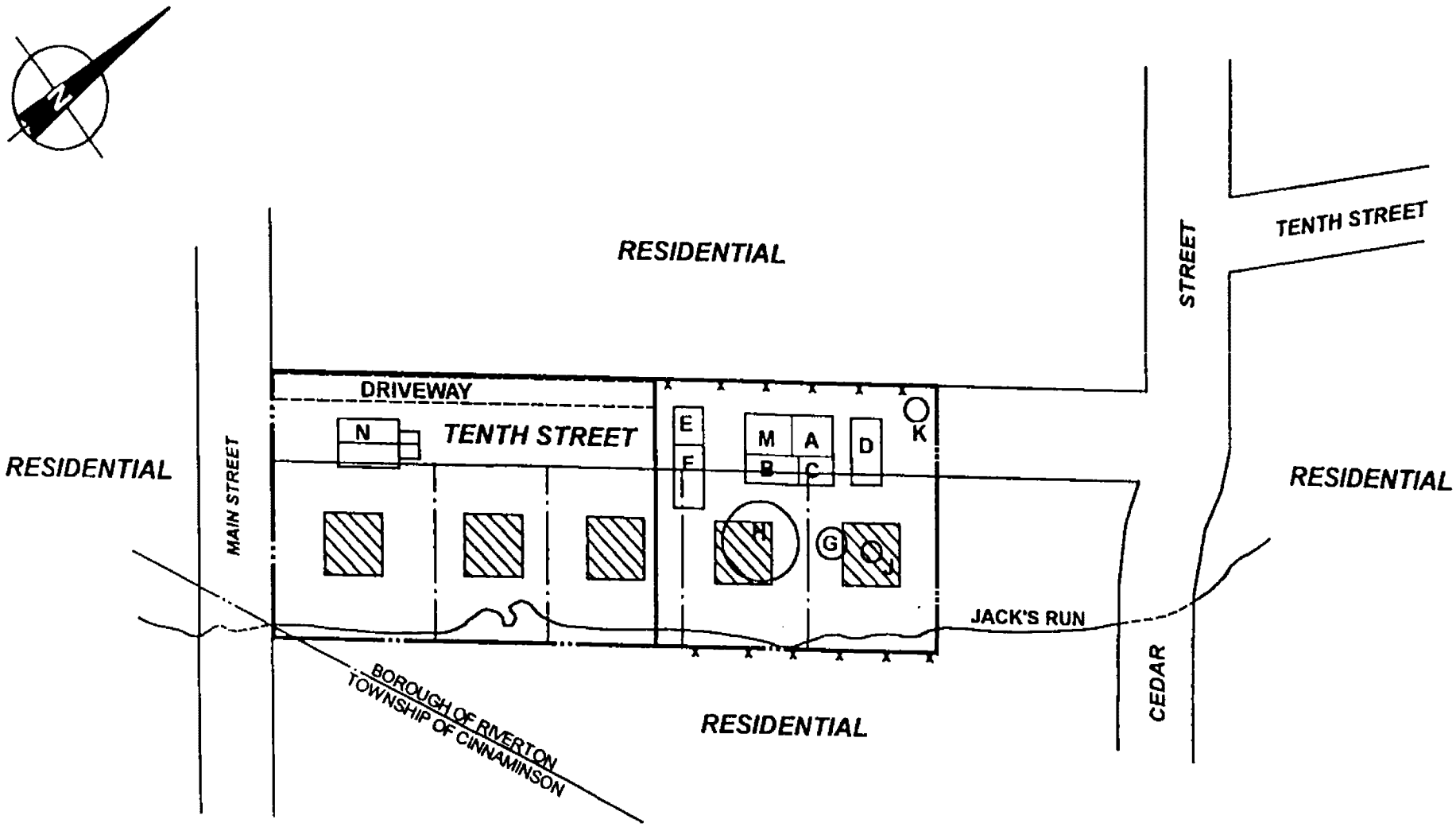
After obtaining assistance as stated above, call the (413) 888-3111 number and follow the procedures in A or B as appropriate.

Safety Plan No.: J007 - 11 Site Name: Chandler Gas Works

## FIELD CHEMICAL CHECKLIST
**(Require MSDS when brought into the field)**

____ Acetone
_X_ Alconox
____ Nitric acid
____ Ascorbic acid
____ Benzene
____ Buffer solutions
____ Conductivity standard
____ Cupric sulfate
____ Ferrous ammonium sulfate
____ Gasoline
____ Hexane
____ Hydrochloric acid
____ Isopropyl alcohol
____ Methanol
____ Methylene chloride
____ Phosphoric acid
____ Potassium iodide
____ Sodium hydroxide
____ Sulfuric acid
____ Toluene
____ 1,1,1-trichloroethane
____ Trichloroethylene

**Gases:**
____ Hydrogen sulfide
____ Isobutylene
____ Methane
____ Nitrogen
_X_ Hydrogen




A. GENERATOR HOUSE
B. PUMPHOUSE
C. BOILER HOUSE
D. COAL SHED
E. STABLE
F. STOREROOM
G. GAS HOLDER (10,000 CF)
H. GAS HOLDER (45,000 CF)
J. STEEL OIL TANK
K. WATER TANK
M. PURIFYING HOUSE
N. DWELLING (WATCHMAN)

**LEGEND**

FORMER FACILITY BOUNDARY

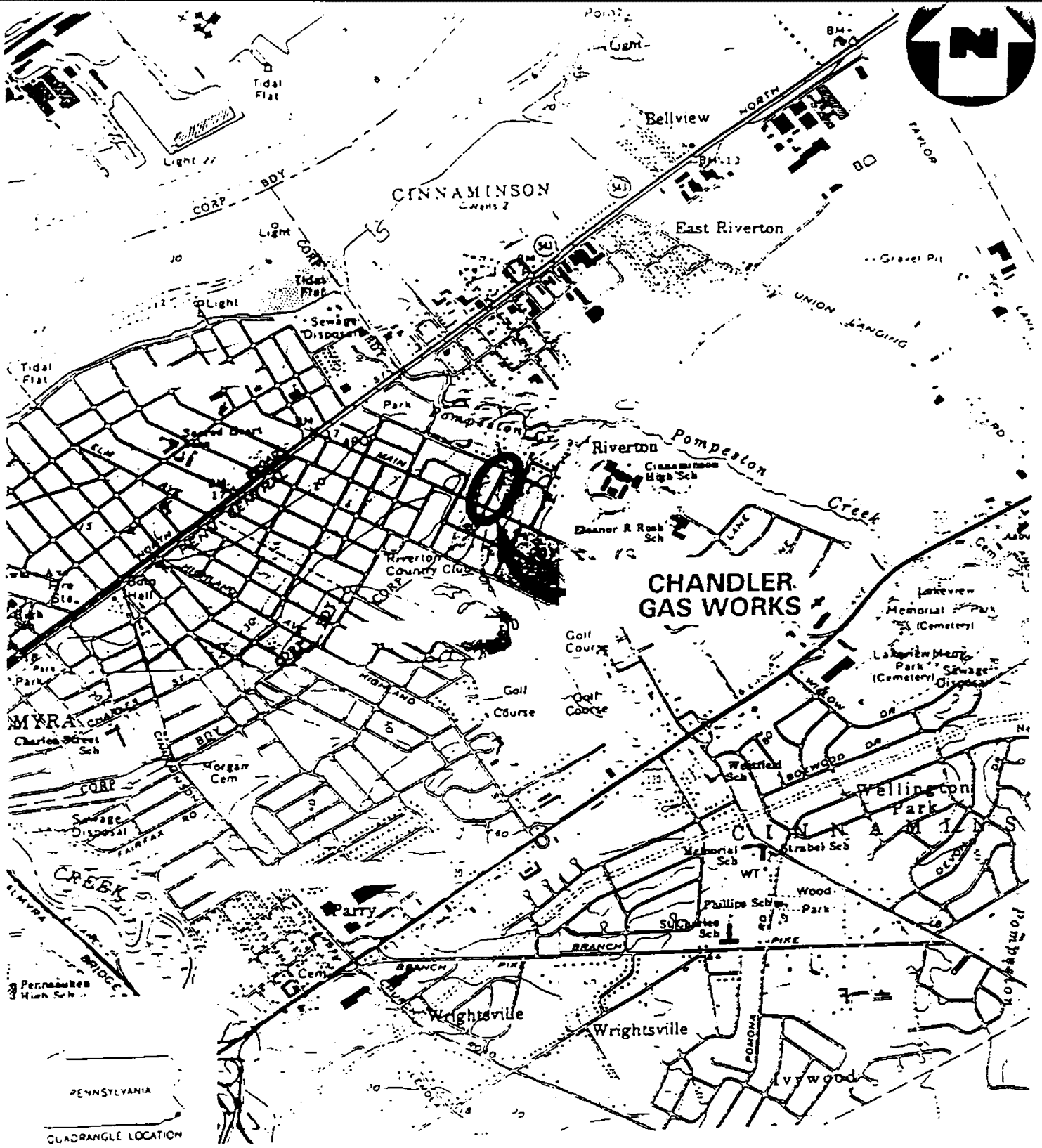
PRESENT SITE CONDITIONS

# CHANDLER GAS WORKS

MAIN & TENTH STREETS
CHANDLER, NEW JERSEY
**FORMER FACILITY LAYOUT**

FIGURE B

SCALE: ± 120'



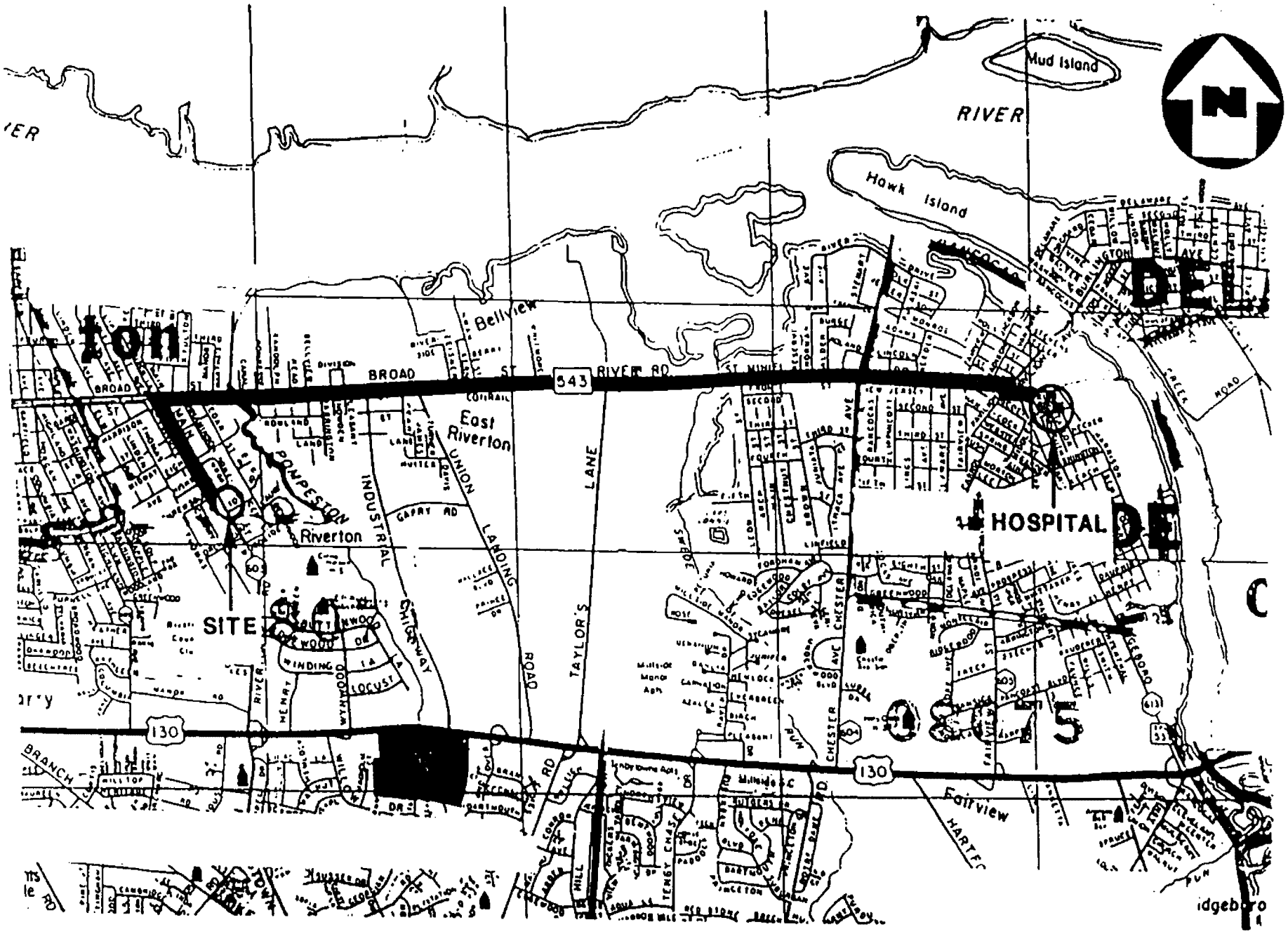

(QUAD) FRANKFORD, N.J.

FIGURE 1

SITE LOCATION MAP

abc environmental

SCALE: 1" = 2000'




ROUTE TO HOSPITAL

# Worksheets

Taken from Chapter 3,
Written Health and Safety Plan,
*Health and Safety Audit Guidelines*

The HASP elements in the box to the right do not appear in the same order as provided in 29 CFR 1910.120(b). Instead, these elements are arranged in the order in which their associated relevant paragraphs appear within 29 CFR 1910.120.

This checklist portion of the EPA Audit Guidelines permits the user to identify inadequacies in the HASP. Answers to the HASP checklist questions should be ascertainable by reviewing the HASP.

At a minimum the HASP should contain the following information:

- Names of key personnel responsible for site safety;
- Safety and health risk analysis for each site task and operation;
- Site control measures;
- Employee training assignments;
- Medical surveillance requirements;
- Personal protective equipment for each of the site tasks and operations;
- Frequency and types of air monitoring, personnel monitoring, environmental sampling techniques and instrumentation along with methods for maintenance and calibration of equipment;
- Confined space entry procedures;
- Spill Containment Program;
- Decontamination procedures; and
- Emergency response plan.

## 3.1 Names of Key Personnel and Health and Safety Personnel - 29 CFR 1910.120(b)(2)

Key personnel may include individuals with job titles such as Project Manager, Field Operations Leader, and Site Supervisor. A Site Health and Safety Officer should also be designated and always be onsite during operations.

3.1.1 Are key personnel identified in the HASP?

[YES] [NO, EXPLAIN]

_____

_____

3.1.2 Are the health and safety personnel (including alternates) identified in the HASP?

[YES] [NO, EXPLAIN]

_____

_____

NOTE: During the field audit, verify key site personnel and the presence of the site health and safety officer.

3.1.3 _____

_____

3.1.4 _____

_____

SUMMARY OF RESPONSES [YES] _____ [NO, EXPLAIN] _____

## 3.2 Safety and Health Risk Analysis for Each Site Task and Operation - 29 CFR 1910.120(b)(4)

Simple risk analyses can be conducted based on the chemical contaminants of concern, the affected media, concentrations, and potential routes of exposure. These elements are essential to any analysis of health risks. OSHA-PELs and IDLH levels should be provided at a minimum for compounds, which have the potential to become airborne. These values can be located for many compounds in the NIOSH/ OSHA Pocket Guide to Chemical Hazards, 1985, as well as in 29 CFR 1910.1000 as published on January 19, 1989 (FR Vol. 54, No. 12).

The HASP also should incorporate some safety risk analyses to address anticipated onsite operations. Certain field operations may be less safe when conducted at a hazardous waste site than if conducted in a more conventional environment. In addition, certain jobs at a hazardous waste site differ in their potential hazards. For instance, the job of a heavy equipment operator or materials handler would generally be a more hazardous job than the job of a supervisor because of the increased risk of direct contact with the concentrated waste. Methods and procedures for reducing safety hazards should be provided in the HASP.

The EPA Superfund Public Health Evaluation Manual (1986), may be useful to users as a tool for performing more sophisticated health risk analyses attributable to common chemical contaminants found at hazardous waste sites. The Guidelines enable the user to calculate hazard indices for chemicals without carcinogenic potential, and to calculate the likely increase in cancer incidence rates associated with exposure to carcinogens at the hazardous waste site.

3.2.1 Does the HASP address methods to deal with potential safety problems (e.g., heavy equipment operations, presence of live electrical sources, and slip, trip, fall hazards)?

[YES] [NO, EXPLAIN]

_____

_____

3.2.2 Does the HASP contain a safety and health risk or hazards analysis for each site task and operation found in the workplan?

[YES] [NO, EXPLAIN]

_____

_____

Note: Verification of incorporation into the HASP of health and safety risk analysis for each site task and operation occurring in the field should be determined during the field audit.

3.2.3 Are chemical contaminants, affected media, concentrations, potential routes of exposure, and health effects identified in the HASP?

[YES] [NO, EXPLAIN]

_____

_____

3.2.4 Does the HASP identify the appropriate PPE level for each site task and operation?

[YES] [NO, EXPLAIN]

_____

_____

3.2.5 _____

_____

3.2.6 _____

_____

SUMMARY OF RESPONSES [YES] _____ [NO, EXPLAIN] _____

## 3.3 Site Control - 29 CFR 1910.120(d)

A site control program is required by 29 CFR 1910.120(d). It should include a site map, site work zones, site communications, safe work practices, and identification of the nearest medical assistance. The "buddy system" should be used throughout site operations.

Site control addresses the establishment of work zones to minimize the hazard to onsite employees and to facilitate site operations.

3.3.1 Does the HASP contain a section on site control defining work zones onsite?

[YES] [NO, EXPLAIN]

_____

_____

3.3.2 Does the HASP contain information on the use of the "buddy system" during all site operations?

[YES] [NO, EXPLAIN]

_____

_____

3.3.3 Does the HASP contain a site map that includes the location of work zones?

[YES] [NO, EXPLAIN]

_____

_____

**NOTE**: Verification of the physical/visual segregation of work zones should be conducted during the field audit.

3.3.4 Does the HASP contain information on site communications?

[YES] [NO, EXPLAIN]

_____

_____

3.3.5 Does the HASP contain information on safe work practices, (e.g., no eating in exclusion zone)?

[YES] [NO, EXPLAIN]

_____

_____

3.3.6 Does the HASP identify the nearest medical assistance?

[YES] [NO, EXPLAIN]

_____

_____

3.3.7 _____

_____

3.3.8 _____

_____

SUMMARY OF RESPONSES [YES] _____ [NO, EXPLAIN] _____

## 3.4 Employee Training - 29 CFR 1910.120(e)

The employee's initial health and safety training, annual health and safety refresher training, on-the-job training, supervisory training (where applicable), first-aid training, CPR training, and other training relevant to the performance of hazardous waste site operations should be indicated in the HASP for all individuals involved in onsite activities.

3.4.1 Does the HASP indicate that all onsite employees meet appropriate health and safety training requirements?

[YES] [NO, EXPLAIN]

_____

_____

If NO, please go on to questions 2-5, while if YES please go on to question 6.

3.4.2 Does the HASP indicate that all individuals expected to be onsite have the requisite initial health and safety training?

[YES] [NO, EXPLAIN]

3.4.3 Does the HASP indicate that individuals functioning in a supervisory capacity have the requisite supervisory training?

[YES] [NO, EXPLAIN]

3.4.4 Does the HASP indicate that all individuals functioning independently of an immediate supervisor have a minimum of three days of actual field experience under a skilled supervisor (on-the-job training)?

[YES] [NO, EXPLAIN]

3.4.5 Does the HASP indicate that all individuals who had their initial health and safety training longer than one year ago have also completed the required annual health and safety refresher training?

[YES] [NO, EXPLAIN]

3.4.6 Does the HASP indicate that employees have had training to recognize the symptoms and signs of overexposure to chemical hazards?

[YES] [NO, EXPLAIN]

3.4.7 If there is no medical facility in proximity to the site, do the training records in the HASP indicate at least one individual onsite who is adequately trained to render first aid (see Appendix B for summary of 29 CFR 1910.151)?

[YES] [NO, EXPLAIN]

_____

_____

3.4.8 _____

_____

3.4.9 _____

_____

_____

SUMMARY OF RESPONSES [YES] _____ [NO, EXPLAIN] _____

## 3.5 Medical Surveillance - 29 CFR 1910.120(f)

29 CFR 1910.120 requires a comprehensive medical surveillance program to monitor the health status of personnel who potentially are exposed to hazardous substances in the field and who wear respirators 30 or more days in a year. The program must include initial and periodic medical examinations, examinations upon termination of employment, and medical recordkeeping.

3.5.1 Does the HASP indicate that site personnel who may be exposed at or above the OSHA-PELs or other published exposure levels or wear respirators 30 or more days each year are enrolled in a comprehensive medical monitoring program before working onsite?

[YES] [NO, EXPLAIN]

_____

_____

3.5.2 _____

_____

3.5.3 _____

_____

SUMMARY OF RESPONSES [YES] _____ [NO, EXPLAIN] _____

## 3.6 Personal Protective Equipment (PPE) - 29 CFR 1910.120(g)

Engineering controls and work practices should first be explored as methods to protect workers before personal protective equipment is used. The standard describes PPE ensembles as Level A, B, C, and D. These levels are described more fully in Appendix D of these Guidelines. PPE ensembles prescribed in the HASP must specifically address the potential site-specific hazards. PPE ensembles themselves may create additional hazards such as heat stress under extreme conditions. Different PPE ensembles may be used for different site operations and in different portions of the same site.

3.6.1 Does the HASP prescribe specific PPE ensembles for each site activity as defined in the site operations/site work plan?

[YES] [NO, EXPLAIN]

_____

_____

3.6.2 Does the HASP contain, or make reference to, a comprehensive, written PPE program specific to site operations that addresses site hazards, duration of site activity, limitations of PPE during temperature extremes, and PPE selection, use, maintenance and storage, decontamination procedures, training and proper fitting, donning and doffing procedures, inspection, and in-use monitoring?

[YES] [NO, EXPLAIN]

_____

_____

3.6.3 _____

_____

3.6.4 _____

_____

SUMMARY OF RESPONSES [YES] _____ [NO, EXPLAIN] _____

## 3.7 Frequency and Types of Air Monitoring, Personnel Monitoring, and Environmental Sampling Techniques - 29 CFR 1910.120(h)

A comprehensive, site-specific air monitoring program must evaluate the exposure potential of all identified and suspected chemical contaminants that could results from all site activities. Typically, such a program consists of two types of air monitoring. First, in 29 CFR 1910.1001-1048, OSHA has published specific personal exposure monitoring requirements for 26 chemical substances including benzene and formaldehyde. The site-specific air monitoring program must meet any applicable requirements as described therein. The program must characterize representative personal exposures. Personal sampling techniques, such as passive dosimeters, diffusion tubes, and charcoal tube sampling with pumps and subsequent laboratory analyses, are described in the NIOSH Manual of Analytical Methods, 3rd Edition (1984).

Second, the program must describe real time air monitoring protocols using direct reading instruments for each site activity as appropriate. These monitoring protocols must describe the frequency and location of all real time monitoring activity, based upon the nature of the site activity. Periodic real time monitoring must be performed, at a minimum, whenever site work begins, operations change, work begins on a different portion of the site, any invasive site activity begins, contaminants other than those previously identified are being handled, personnel begin to handle obviously contaminated materials or personnel are handling leaking drums or containers. Monitoring efforts should focus on personnel most likely to receive the highest exposures and on all personnel likely to be exposed to any substance above the OSHA-Permissible Exposure Limit (OSHA-PEL). OSHA has recent revised its list of air contaminants and their accompanying standards. These air contaminants and their respective OSHA-PELs are available in Air Contaminants - Permissible Exposure Limits - OSHA 3112; 1989.

3.7.1 Does the HASP indicate that upon initial entry, representative air monitoring shall be conducted to identify IDLH conditions, exposure above OSHA-PELs or other published exposure levels including exposure to radiation, flammable atmospheres, and/or oxygen-deficient atmospheres?

[YES] [NO, EXPLAIN]

_____

_____

3.7.2 Does the HASP describe the components of an air monitoring program that addresses all known and suspected site contaminants for all site activities?

[YES] [NO, EXPLAIN]

_____

_____

3.7.3 Are there any chemical substances listed in 29 CFR 1910.1001-1048 known or expected to be onsite?

[YES] [NO, EXPLAIN]

_____

_____

If question "3" was answered [YES], does the HASP prescribe personal monitoring programs to meet the specific personal monitoring requirements described in that rule?

[YES] [NO, EXPLAIN]

_____

_____

3.7.4 Does the HASP specify regular maintenance and calibration of all real time air monitoring instruments?

[YES] [NO, EXPLAIN]

_____

_____

3.7.5 _____

_____

3.7.6 _____

_____

SUMMARY OF RESPONSES [YES] _____ [NO, EXPLAIN] _____

## 3.8 Confined Space Entry Procedures - 29 CFR 1910.120(j)(9)

If confined space entries are anticipated during site activities, then confined space entry procedures should be detailed in the HASP. Entry into an abandoned building or a storage vessel may be examples of confined space entries..

3.8.1 If confined space entry is anticipated onsite, does the HASP contain a section on procedures for confined space entry?

[YES] [NOT APPLICABLE] [NO, EXPLAIN]

A [NOT APPLICABLE] response may indicate that confined space entry onsite is not anticipated.

NOTE: During the field audit, verify that the confined space entry procedures provided in the HASP are appropriate to field conditions.

3.8.2 _____

_____

3.8.3 _____

_____

SUMMARY OF RESPONSES [YES] _____ [NO, EXPLAIN] _____

## 3.9 Spill Containment Program - 29 CFR 1910.120(j)

In a spill/release of a hazardous chemical onsite, the HASP should contain detailed information in a spill containment program. The elements that may need to be addressed in the spill containment program include:

Drum and Container Handling
Opening of Drums and Containers
Material Handling Equipment
Radioactive Wastes
Shock-Sensitive Wastes
Laboratory Waste Packs
Sampling of Drum and Container Contents
Shipping and Transport of Drums and Containers
Appropriate Procedures for Tank and Vault Entry

3.9.1 Does the HASP contain a section addressing elements of a spill containment program that are relevant to the site?

[YES] [NO, EXPLAIN]

_____

_____

3.9.2 Where there is a potential for a major spill, does the HASP provide adequate information for the containment and isolation of the entire volume of any hazardous substance being transferred?

[YES] [NO, EXPLAIN]

_____

_____

3.9.3 _____

_____

_____

3.9.4 _____

_____

SUMMARY OF RESPONSES [YES] _____ [NO, EXPLAIN] _____

## 3.10 Decontamination - 29 CFR 1910.120(k)

Decontamination involves the safe removal of chemical contaminants from employees and equipment. Decontamination procedures should be chosen to match the anticipated contaminants for the site.

3.10.1 Does the HASP contain a section on decontamination of employees and equipment?

[YES] [NO, EXPLAIN]

_____

_____

3.10.2 Are the decontamination procedures in the HASP appropriate for the anticipated onsite contaminants?

[YES] [NO, EXPLAIN]

_____

_____

3.10.3 Does the HASP provide for monitoring of decontamination procedures by the site health and safety supervisor?

[YES] [NO, EXPLAIN]

_____

_____

3.10.4 _____

_____

3.10.5 _____

_____

SUMMARY OF RESPONSES [YES] _____ [NO, EXPLAIN] _____

## 3.11 Emergency Response Plan - 29 CFR 1910.120(l)

Hazardous waste sites can present high hazard environments. Therefore, a program addressing potential emergency situations must be included in the HASP. Such a contingency plan should be communicated to employees onsite through the HASP, as well as through safety meetings and briefings. The emergency response plan portion of the HASP should be sufficiently detailed to ensure prompt, safe evacuation of all employees from the site in the event of an emergency. It is recommended that the auditor call the phone numbers provided in the HASP for fire, police, ambulance, and hospital to determine the accuracy of these phone numbers. A method for determining wind direction that is visible to employees in the event of a site evacuation is useful in the HASP.

3.11.1 Does the HASP contain a separate section for the emergency response plan that is available for inspection and copying by employees, their representatives, OSHA personnel, and other governmental agencies with relevant responsibilities?

[YES] [NO, EXPLAIN]

_____

_____

3.11.2 Does the emergency response plan in the HASP provide for onsite emergencies by addressing the following elements?

3.11.2.1 Pre-emergency planning?

[YES] [NO, EXPLAIN]

_____

_____

311.2.2 Personnel roles, lines of authority, and communication?

[YES] [NO, EXPLAIN]

_____

_____

311.2.3 Emergency recognition and prevention?

[YES] [NO, EXPLAIN]

_____

_____

3.11.2.4 Safe distances and places of refuge in the event of an unexpected chemical spill/ release?

[YES] [NO, EXPLAIN]

3.11.2.5 Site security and control?

[YES] [NO, EXPLAIN]

3.11.2.6 Evacuation routes and procedures?

[YES] [NO, EXPLAIN]

3.11.2.7 Decontamination procedures not covered in other parts of the HASP?

[YES] [NO, EXPLAIN]

3.11.2.8 Emergency medical treatment and first aid?

[YES] [NO, EXPLAIN]

3.11.2.9 Emergency alerting and response procedures?

[YES] [NO, EXPLAIN]

3.11.2.10 Procedure for critique of response and follow-up?

[YES] [NO, EXPLAIN]

_____

_____

3.11.2.11 PPE and emergency equipment?

[YES] [NO, EXPLAIN]

_____

_____

3.11.2.12 Site topography, layout, and prevailing weather conditions?

[YES] [NO, EXPLAIN]

_____

_____

SUMMARY OF RESPONSES [YES] _____ [NO, EXPLAIN] _____

## Conclusion

- Safety and Health Compliance with 29 CFR 1910.120
- Safety and Health Construction Standards
- Toxic and Hazardous Substances Standards
- Safety and Health Program, Paragraph (b)
- Hazard and Risk Analysis
- Air Monitoring Plans and Strategies
- Air Impact Assessments
- Personal Protective Equipment Decision-making
- Confined Space Entry Program
- Spill Containment Program
- Emergency Response Plans
- Summary: Site-specific Health and Safety Plan
- **Audit Guidelines**

**TP-5**

### Crossword Puzzle

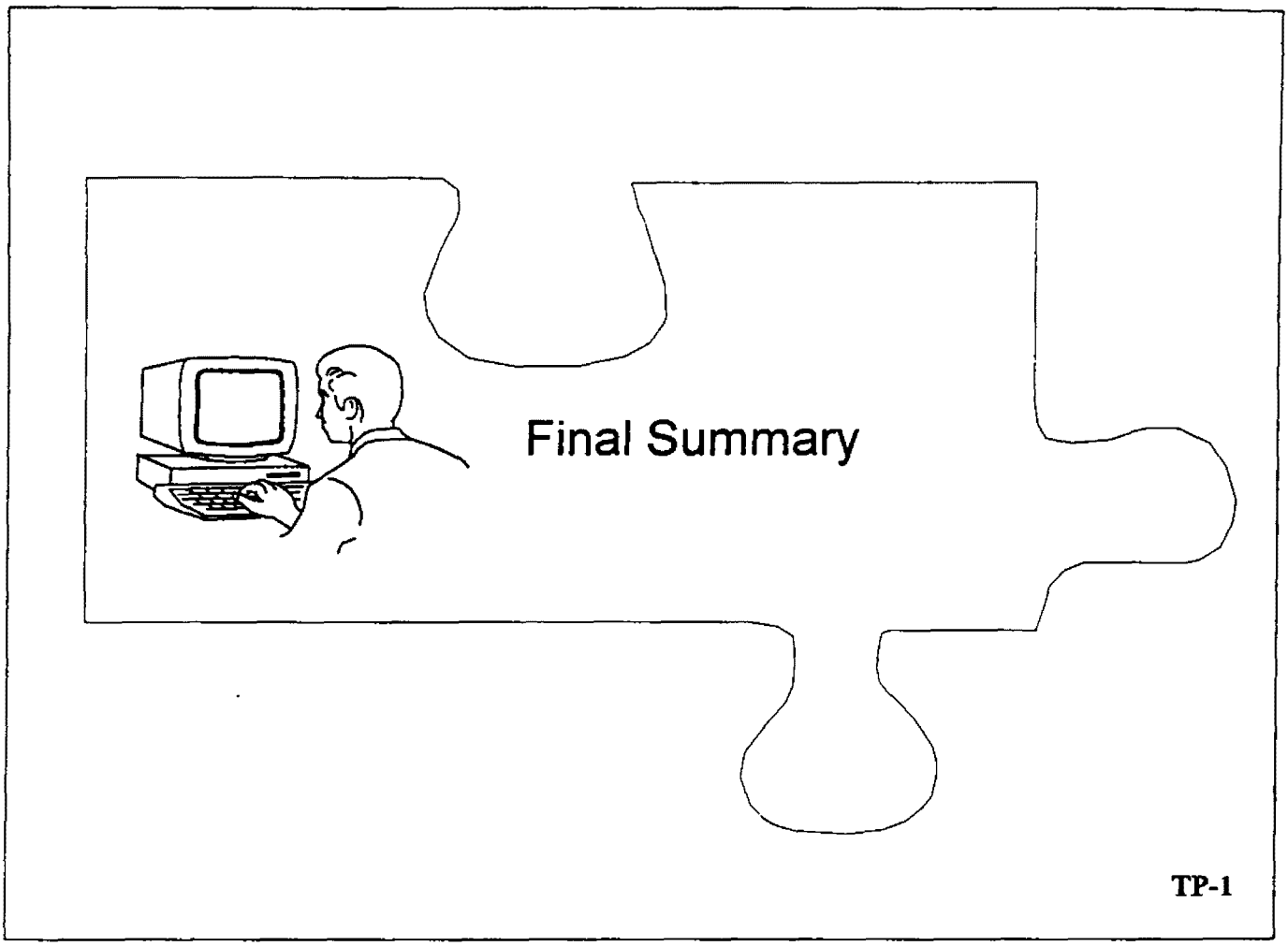
**Across**

13. One of the eight elements of a preliminary evaluation is site _____/site accessibility
44. Chapter 5 of the Audit Guidelines document covers planning, equipment, _____ surveillance, and training

**Down**

24. Health and Safety Audit Guidelines refers to what body of legislation? (acronym)

# FINAL SUMMARY




## *Module Goals:*

The student goals for this module are:

1. Given presented material, summarize the Safety and Health Decision-making for Managers (SHDMFM) course.

2. Given presented material, identify computer software tools available for safety and health decision-making at hazardous waste sites.

# Safety and Health Decision-making for Managers
## Conclusion

Summary of Course

- Regulatory compliance
- Safety and health program
- Site-specific plan development: Standard Operating Safety Guides (SOSGs) and/or standard operating procedures (SOPs)
- Special considerations
- Audit guidelines

TP-2

Given presented material, summarize the SHDMFM course.

## Regulatory Compliance

- Safety and Health Compliance with 29 CFR 1910.120
- Safety and Health Construction Standards (29 CFR 1926)
- Toxic and Hazardous Substances Standards (29 CFR 1910 Subpart Z)

TP-3

## Safety and Health Program

- General requirements
- Training requirements
- Medical surveillance
- Site-specific health and safety plan (HASP)

TP-4

## Site-specific Plan Development: SOSGs and/or SOPs

- Hazard and Risk Analysis
- Air Monitoring Plans and Strategies
- Air Impact Assessments
- Personal Protective Equipment Decision-making

TP-5

## Special Considerations

- Permit-required confined space entry (1910.146)
- Spill containment program
- Emergency response planning components
  - Emergency plan
  - Reporting requirements

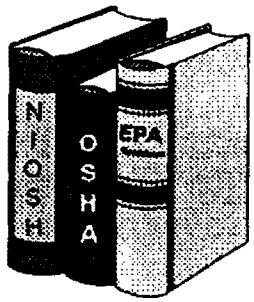
TP-6

## Audit Guidelines

Site-specific HASP (completed)

TP-7

# Available Guidance




- 29 CFR 1910.120
- U.S. Environmental Protection Agency (EPA) SOSGs
- NIOSH/OSHA/USCG/EPA Occupational Safety and Health Guidance Manual (1985)
- EPA fact sheets
- EPA Health and Safety Audit Guidelines
- EPA computer software

TP-8

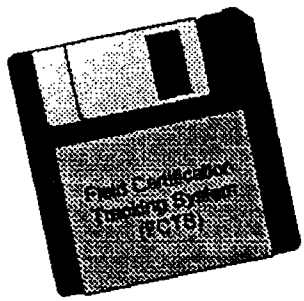
Given presented material, identify computer software tools available for safety and health decision-making at hazardous waste sites.

## EPA Computer Software Tools

- Quality Assurance of Sampling Plans for Environmental Response (QASPER)
- Recovery Cost Management System (RCMS)
- DrumTrak

TP-9

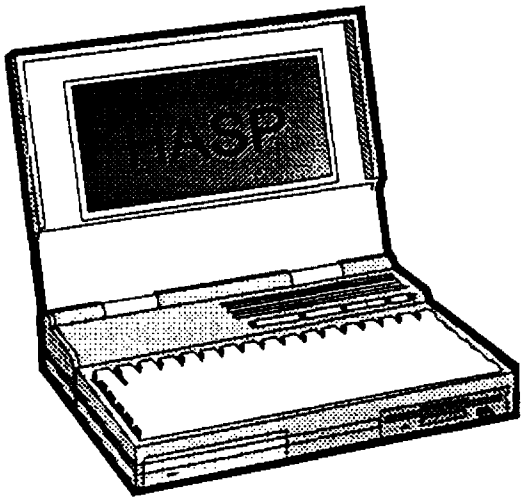
# EPA Computer Software Tools (cont.)




- Air Methods Database
- Field Certification Tracking System (FCTS)

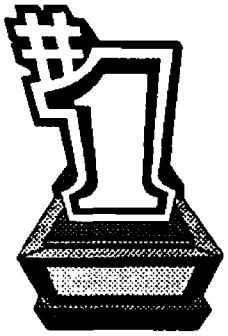
**TP-10**

# EPA Computer Software Tools (cont.)




TP-11

# Conclusion



- Awards presentation
- Certificates
- Evaluations

**TP-12**

# APPENDIX
## Order Form

**Environmental Response Center**
**US EPA - ERT**
**2890 Woodbridge Avenue**
**Building #18 (MS101)**
**Edison NJ 08837-3679**
**1-800-999-6990**
**FAX: 1-908-321-4392**

**Distribution Request Form**

**Name:** _____ **Date:** _____

**Company:** _____

**Street:** _____

**City/State/Zip:** _____

**Telephone:** ( ) _____

**Type of Business (circle one):** **Federal—State—Local—Private**

**or Other:** _____

**Order Taken By:** _____ **Class Given By:** _____

**Environmental Utilities Software Packages:**

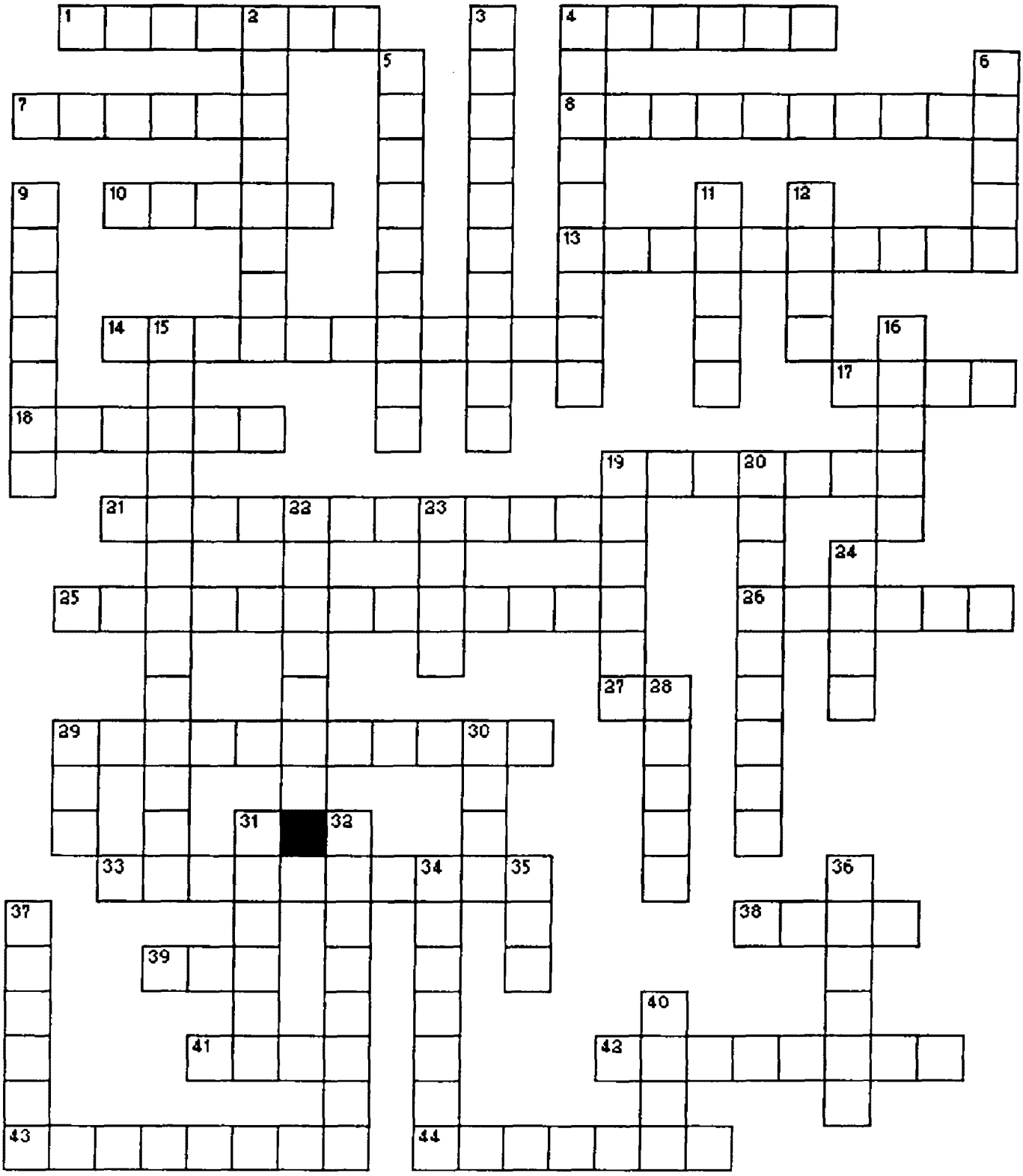
| Title | Quantity |
|---|---|
| Air Methods Database | _____ |
| Field Certification Tracking System (FCTS 9285.3-03) | _____ |
| Health and Safety Plan (HASP 9285.8-01) | _____ |
| Quality Assurance Sampling Plan for Environmental Response (QASPER) | _____ |

(Distrib/Request FRM 12/95)

**Facts Sheets:**

| Title | Quantity |
|---|---|
| Hazardous Waste Operations and Emergency Response (HAZWOPER): Establishing Work Zones at Uncontrolled Hazardous Waste Sites (9285.2-06FS) | _____ |
| HAZWOPER: Uncontrolled Hazardous Waste Sites and RCRA Corrective Actions (9285.2-08FS) | _____ |
| HAZWOPER: RCRA TSD and Emergency Response Without Regard to Location (9285.2-07FS) | _____ |
| HAZWOPER: General Information and Comparison (9285.2-09FS) | _____ |
| HAZWOPER: Available Guidance (9285.2-10FS) | _____ |
| The Effect of OSHA's Bloodborne Pathogens Standard on Hazardous Waste Cleanup Activities (9360.0-31/FS) | _____ |
| Personal Air Sampling and Monitoring Requirements Under 29 CFR 1910.120 (9360.8-17/FS) | _____ |
| Health and Safety Roles and Responsibilities at Remedial Sites (9285.1-02) | _____ |
| The Penta Wood Products Site: Analysis of Pentachlorophenol Using a Mobile Laboratory Equipped with State-of-the-Art Instrumentation (9200.5-5-160FS) | _____ |
| Indoor Air Analysis of Volatile Organic Compounds Using Capillary Column Gas Chromatography/Mass Spectrometry (9380.5-14FS) | _____ |
| Wood Treating Sites: Analysis of PCP and Creosote Using on Site Mobile High Hazard Laboratory (9380.1-15FS) | _____ |

# Safety and Health Decision-making for Managers
## Crossword Puzzle



# 1910.120—HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE

## (a) Scope, application, and definitions.

(1) **Scope.** This section covers the following operations, unless the employer can demonstrate that the operation does not involve employee exposure or the reasonable possibility for employee exposure to safety or health hazards:

(i) Clean-up operations required by a governmental body, whether Federal, state, local or other involving hazardous substances that are conducted at uncontrolled hazardous waste sites (including, but not limited to, the EPA's National Priority Site List (NPL), state priority site lists, sites recommended for the EPA NPL, and initial investigations of government identified sites which are conducted before the presence or absence of hazardous substances has been ascertained);

(ii) Corrective actions involving cleanup operations at sites covered by the Resource Conservation and Recovery Act of 1976 (RCRA) as amended (42 U.S.C. 6901 *et seq.*);

(iii) Voluntary clean-up operations at sites recognized by Federal, state, local or other governmental bodies as uncontrolled hazardous waste sites;

(iv) Operations involving hazardous wastes that are conducted at treatment, storage, and disposal (TSD) facilities regulated by 40 CFR Parts 264 and 265 pursuant to RCRA; or by agencies under agreement with U.S.E.P.A. to implement RCRA regulations; and

(v) Emergency response operations for releases of, or substantial threats of releases of, hazardous substances without regard to the location of the hazard.

(2) **Application.**

(i) All requirements of Part 1910 and Part 1926 of Title 29 of the Code of Federal Regulations apply pursuant to their terms to hazardous waste and emergency response operations whether covered by this section or not. If there is a conflict or overlap, the provision more protective of employee safety and health shall apply without regard to 29 CFR 1910.5(c)(1).

(ii) Hazardous substance clean-up operations within the scope of paragraphs (a)(1)(i) through (a)(1)(iii) of this section must comply with all paragraphs of this section except paragraphs (p) and (q).

(iii) Operations within the scope of paragraph (a)(1)(iv) of this section must comply only with the requirements of paragraph (p) of this section.

Exceptions: For large quantity generators of hazardous waste who store those wastes less than 90 days and for small quantity generators of hazardous wastes, who have emergency response teams that respond to releases of, or substantial threats of releases of, hazardous substances, for their RCRA workplaces only paragraph (p)(8) of this section is applicable. Such generators of hazardous wastes who do not have emergency response teams that respond to releases of, or substantial threats of releases of, hazardous substances are exempt from the requirements of this section.

(iv) Emergency response operations for releases of, or substantial threats of releases of, hazardous substances which are not covered by paragraphs (a)(1)(i) through (a)(1)(iv) of this section must only comply with the requirements of paragraph (q) of this section.

(3) **Definitions.** "Buddy system" means a system of organizing employees into work groups in such a manner that each employee of the work group is designated to be observed by at least one other employee in the work group. The purpose of the buddy system is to provide rapid assistance to employees in the event of an emergency.

"Clean-up operation" means an operation where hazardous substances are removed, con-

tained, incinerated, neutralized, stabilized, cleared-up, or in any other manner processed or handled with the ultimate goal of making the site safer for people or the environment.

"Decontamination" means the removal of hazardous substances from employees and their equipment to the extent necessary to preclude the occurrence of foreseeable adverse health affects.

"Emergency response" or "responding to emergencies" means a response effort by employees from outside the immediate release area or by other designated responders (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. Responses to incidental releases of hazardous substances where the substance can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area, or by maintenance personnel are not considered to be emergency responses within the scope of this standard. Responses to releases of hazardous substances where there is no potential safety or health hazard (i.e., fire, explosion, or chemical exposure) are not considered to be emergency responses.

"Facility" means (A) any building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publicly owned treatment works), well, pit, pond, lagoon, impoundment, ditch, storage container, motor vehicle, rolling stock, or aircraft, or (B) any site or area where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located; but does not include any consumer product in consumer use or any water-borne vessel.

(3) "Hazardous materials response (HAZMAT) team" means an organized group of employees, designated by the employer, who are expected to perform work to handle and control actual or potential leaks or spills of hazardous substances requiring possible close approach to the substance. The team members perform responses to releases or potential releases of hazardous substances for the purpose of control or stabilization of the incident. A HAZMAT team is not a fire brigade nor is a typical fire brigade a HAZMAT team. A HAZMAT team, however, may be a separate component of a fire brigade or fire department.

"Hazardous substance" means any substance designated or listed under paragraphs (A) through (D) of this definition, exposure to which results or may result in adverse affects on the health or safety of employees:

(a) Any substance defined under section 101(14) of CERCLA;

(b) Any biological agent and other disease-causing agent as defined in section 101(33) of CERCLA;

(c) Any substance listed by the U.S. Department of Transportation as hazardous materials under 49 CFR 172.101 and appendices; and

(d) Hazardous waste as herein defined.

"Hazardous waste" means

(a) A waste or combination of wastes as defined in 40 CFR 261.3, or

(b) Those substances defined as hazardous wastes in 49 CFR 171.8.

"Hazardous waste operation" means any operation conducted within the scope of this standard.

"Hazardous waste site" or "Site" means any facility or location within the scope of this standard at which hazardous waste operations take place.

*"Health hazard"* means a chemical, mixture of chemicals or a pathogen for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. the term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, heptaotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes. It also includes stress due to temperature extremes. Further definition of the terms used above can be found in Appendix A to 29 CFR 1910.1200.

"IDLH" or "Immediately dangerous to life or health" means an atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would cause irrever-

sible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere.

"Oxygen deficiency" means that concentration of oxygen by volume below which atmosphere supplying respiratory protection must be provided. It exists in atmospheres where the percentage of oxygen by volume is less than 19.5 percent oxygen.

"Permissible exposure limit" means the exposure, inhalation or dermal permissible exposure limit specified in 29 CFR Part 1910, Subparts G and Z.

"Published exposure level" means the exposure limits published in "NIOSH Recommendations for Occupational Health Standards" dated 1986 incorporated by reference, or if none is specified, the exposure limits published in the standards specified by the American Conference of Governmental Industrial Hygienists in their publication "Threshold Limit Values and Biological Exposure Indices for 1987–88" dated 1987 incorporated by reference.

"Post emergency response" means that portion of an emergency response performed after the immediate threat of a release has been stabilized or eliminated and clean-up of the site has begun. If post emergency response is performed by an employer's own employees who were part of the initial emergency response, it is considered to be part of the initial response and not post emergency response. However, if a group of an employer's own employees, separate from the group providing initial response, performs the clean-up operation, then the separate group of employees would be considered to be performing post-emergency response and subject to paragraph (g)(11) of this section.

"Qualified person" means a person with specific training, knowledge and experience in the area for which the person has the responsibility and the authority to control.

"Site safety and health supervisor (or official)" means the individual located on a hazardous waste site who is responsible to the employer and has the authority and knowledge necessary to implement the site safety and health plan and verify compliance with applicable safety and health requirements.

"Small quantity generator" means a generator of hazardous wastes who in any calendar month generates no more than 1,000 kilograms (2,205 pounds) of hazardous waste in that month.

"Uncontrolled hazardous waste site" means an area where an accumulation of hazardous waste creates a threat to the health and safety of individuals or the environment or both. Some sites are found on public lands, such as those created by former municipal, county or state landfills where illegal or poorly managed waste disposal has taken place. Other sites are found on private property, often belonging to generators or former generators of hazardous waste. Examples of such sites include, but are not limited to, surface impoundments, landfills, dumps, and tank or drum farms. Normal operations at TSD sites are not covered by this definition.

## (b) Safety and health program.

**Note to (b):** Safety and health programs developed and implemented to meet other Federal, state, or local regulations are considered acceptable in meeting this requirement if they cover or are modified to cover the topics required in this paragraph. An additional or separate safety and health program is not required by this paragraph.

### (1) General.

(i) Employers shall develop and implement a written safety and health program for their employees involved in hazardous waste operations. The program shall be designed to identify, evaluate, and control safety and health hazards, and provide for emergency response for hazardous waste operations.

(ii) The written safety and health program shall incorporate the following:

(a) An organizational structure;

(b) A comprehensive workplan;

(c) A site-specific safety and health plan which need not repeat the employer's standard operating procedures required in paragraph (b)(1)(ii)(F) of this section;

(d) The safety and health training program;

(e) The medical surveillance program;

(f) The employer's standard operating procedures for safety and health; and

(g) Any necessary interface between general program and site specific activities.

**(iii) Site excavation.** Site excavations created during initial site preparation or during hazardous waste operations shall be shored or sloped as appropriate to prevent accidental collapse in accordance with Subpart P of 29 CFR Part 1926.

**(iv) Contractors and sub-contractors.** An employer who retains contractor or subcontractor services for work in hazardous waste operations shall inform those contractors, sub-contractors, or their representatives of the site emergency response procedures and any potential fire, explosion, health, safety or other hazards of the hazardous waste operation that have been identified by the employer, including those identified in the employer's information program.

**(v) Program availability.** The written safety and health program shall be made available to any contractor or subcontractor or their representative who will be involved with the hazardous waste operation; to employees; to employee designated representatives; to OSHA personnel, and to personnel of other Federal, state, or local agencies with regulatory authority over the site.

**(2) Organizational structure part of the site program.**

(i) The organizational structure part of the program shall establish the specific chain of command and specify the overall responsibilities of supervisors and employees. It shall include, at a minimum, the following elements:

(a) A general supervisor who has the responsibility and authority to direct all hazardous waste operations.

(b) A site safety and health supervisor who has the responsibility and authority to develop and implement the site safety and health plan and verify compliance.

(c) All other personnel needed for hazardous waste site operations and emergency response and their general functions and responsibilities.

(d) The lines of authority, responsibility, and communication.

(ii) The organizational structure shall be reviewed and updated as necessary to reflect the current status of waste site operations.

**(3) Comprehensive workplan part of the site program.** The comprehensive workplan part of the program shall address the tasks and objectives of the site operations and the logistics and resources required to reach those tasks and objectives.

(i) The comprehensive workplan shall address anticipated clean-up activities as well as normal operating procedures which need not repeat the employer's procedures available elsewhere.

(ii) The comprehensive workplan shall define work tasks and objectives and identify the methods for accomplishing those tasks and objectives.

(iii) The comprehensive workplan shall establish personnel requirements for implementing the plan.

(iv) The comprehensive workplan shall provide for the implementation of the training required in paragraph (e) of this section.

(v) The comprehensive workplan shall provide for the implementation of the required informational programs required in paragraph (i) of this section.

(vi) The comprehensive workplan shall provide for the implementation of the medical surveillance program described in paragraph (f) of this section.

**(4) Site-specific safety and health plan part of the program.**

(i) **General.** The site safety and health plan, which must be kept on site, shall address the safety and health hazards of each phase of site operation and include the requirements and procedures for employee protection.

(ii) **Elements.** The site safety and health plan, as a minimum, shall address the following:

(a) A safety and health risk or hazard analysis for each site task and operation found in the workplan.

(b) Employee training assignments to assure compliance with paragraph (e) of this section.

(c) Personal protective equipment to be used by employees for each of the site tasks and operations being conducted as required by the personal protective equipment program in paragraph (g)(5) of this section.

(d) Medical surveillance requirements in accordance with the program in paragraph (f) of this section.

(e) Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used, including methods of maintenance and calibration of monitoring and sampling equipment to be used.

(f) Site control measures in accordance with the site control program required in paragraph (d) of this section.

(g) Decontamination procedures in accordance with paragraph (k) of this section.

(h) An emergency response plan meeting the requirements of paragraph (l) of this section for safe and effective responses to emergencies, including the necessary PPE and other equipment.

(i) Confined space entry procedures.

(j) A spill containment program meeting the requirements of paragraph (j) of this section.

(iii) **Pre-entry briefing.** The site specific safety and health plan shall provide for pre-entry briefings to be held prior to initiating any site activity, and at such other times as necessary to ensure that employees are apprised of the site safety and health plan and that this plan is being followed. The information and data obtained from site characterization and analysis work required in paragraph (c) of this section shall be used to prepare and update the site safety and health plan.

(iv) **Effectiveness of site safety and health plan.** Inspections shall be conducted by the site safety and health supervisor or, in the absence of that individual, another individual who is knowledgeable in occupational safety and health, acting on behalf of the employer as necessary to determine the effectiveness of the site safety and health plan. Any deficiencies in the effectiveness of the site safety and health plan shall be corrected by the employer.

## (c) Site characterization and analysis.

(1) **General.** Hazardous waste sites shall be evaluated in accordance with this paragraph to identify specific site hazards and to determine the appropriate safety and health control procedures needed to protect employees from the identified hazards.

(2) **Preliminary evaluation.** A preliminary evaluation of a site's characteristics shall be performed prior to site entry by a qualified person in order to aid in the selection of appropriate employee protection methods prior to site entry. Immediately after initial site entry, a more detailed evaluation of the site's specific characteristics shall be performed by a qualified person in order to further identify existing site hazards and to further aid in the selection of the appropriate engineering controls and personal protective equipment for the tasks to be performed.

(3) **Hazard identification.** All suspected conditions that may pose inhalation or skin absorption hazards that are immediately dangerous to life or health (IDLH), or other conditions that may cause death or serious harm, shall be identified during the preliminary survey and evaluated during the detailed survey. Examples of such hazards include, but are not limited to, confined space entry, potentially explosive or flammable situations, visible vapor clouds, or areas where biological indicators such as dead animals or vegetation are located.

(4) **Required information.** The following information to the extent available shall be obtained by the employer prior to allowing employees to enter a site:

(i) Location and approximate size of the site.

(ii) Description of the response activity and/or the job task to be performed.

(iii) Duration of the planned employee activity.

(iv) Site topography and accessibility by air and roads.

(v) Safety and health hazards expected at the site.

(vi) Pathways for hazardous substance dispersion.

(vii) Present status and capabilities of emergency response teams that would provide assistance to hazardous waste clean-up site employees at the time of an emergency.

(viii) Hazardous substances and health hazards involved or expected at the site, and their chemical and physical properties.

(5) **Personal protective equipment.** Personal protective equipment (PPE) shall be provided and used during initial site entry in accordance with the following requirements:

(i) Based upon the results of the preliminary site evaluation, an ensemble of PPE shall be selected and used during initial site entry which will provide protection to a level of exposure below permissible exposure limits and published exposure levels for known or suspected hazardous substances and health hazards, and which will provide protection against other known and suspected hazards identified during the preliminary site evaluation. If there is no permissible exposure limit or published exposure level, the employer may use other published studies and information as a guide to appropriate personal protective equipment.

(ii) If positive-pressure self-contained breathing apparatus is not used as part of the entry ensemble, and if respiratory protection is warranted by the potential hazards identified during the preliminary site evaluation, an escape self-contained breathing apparatus of at least five minute's duration shall be carried by employees during initial site entry.

(iii) If the preliminary site evaluation does not produce sufficient information to identify the hazards or suspected hazards of the site, an ensemble providing protection equivalent to Level B PPE shall be provided as minimum protection, and direct reading instruments shall be used as appropriate for identifying IDLH conditions. (See Appendix B for a description of Level B hazards and the recommendations for Level B protective equipment.)

(iv) Once the hazards of the site have been identified, the appropriate PPE shall be selected and used in accordance with paragraph (g) of this section.

(6) **Monitoring.** The following monitoring shall be conducted during initial site entry when the site evaluation produces information that shows the potential for ionizing radiation or IDLH conditions, or when the site information is not sufficient reasonably to eliminate these possible conditions:

(i) Monitoring with direct reading instruments for hazardous levels of ionizing radiation.

(ii) Monitoring the air with appropriate direct reading test equipment (i.e., combustible gas meters, detector tubes) for IDLH and other conditions that may cause death or serious harm (combustible or explosive atmospheres, oxygen deficiency, toxic substances).

(iii) Visually observing for signs of actual or potential IDLH or other dangerous conditions.

(iv) An ongoing air monitoring program in accordance with paragraph (h) of this section shall be implemented after site characterization has determined the site is safe for the startup of operations.

(7) **Risk identification.** Once the presence and concentrations of specific hazardous substances and health hazards have been established, the risks associated with these substances shall be identified. Employees who will be working on the site shall be informed of any risks that have been identified. In situations covered by the Hazard Communication Standard, 29 CFR 1910.1200, training required by that standard need not be duplicated.

**Note to (c)(7).**—Risks to consider include, but are not limited to:

(a) Exposures exceeding the permissible exposure limits and published exposure levels.

(b) IDLH concentrations.

(c) Potential skin absorption and irritation sources.

(d) Potential eye irritation sources.

(e) Explosion sensitivity and flammability ranges.

(f) Oxygen deficiency.

**(8) Employee notification.** Any information concerning the chemical, physical, and toxicologic properties of each substance known or expected to be present on site that is available to the employer and relevant to the duties an employee is expected to perform shall be made available to the affected employees prior to the commencement of their work activities. The employer may utilize information developed for the hazard communication standard for this purpose.

## (d) Site control.

**(1) General.** Appropriate site control procedures shall be implemented to control employee exposure to hazardous substances before clean-up work begins.

**(2) Site control program.** A site control program for protecting employees which is part of the employer's site safety and health program required in paragraph (b) of this section shall be developed during the planning stages of a hazardous waste clean-up operation and modified as necessary as new information becomes available.

**(3) Elements of the site control program.** The site control program shall, as a minimum, include: A site map; site work zones; the use of a "buddy system"; site communications including alerting means for emergencies; the standard operating procedures or safe work practices; and, identification of the nearest medical assistance. Where these requirements are covered elsewhere they need not be repeated.

## (e) Training.

**(1) General.**

(i) All employees working on site (such as but not limited to equipment operators, general laborers and others) exposed to hazardous substances, health hazards, or safety hazards and their supervisors and management responsible for the site shall receive training meeting the requirements of this paragraph before they are permitted to engage in hazardous waste operations that could expose them to hazardous substances, safety, or health hazards, and they shall receive review training as specified in this paragraph.

(ii) Employees shall not be permitted to participate in or supervise field activities until they have been trained to a level required by their job function and responsibility.

**(2) Elements to be covered.** The training shall thoroughly cover the following:

(i) Names of personnel and alternates responsible for site safety and health;

(ii) Safety, health and other hazards present on the site;

(iii) Use of personal protective equipment;

(iv) Work practices by which the employee can minimize risks from hazards;

(v) Safe use of engineering controls and equipment on the site;

(vi) Medical surveillance requirements, including recognition of symptoms and signs which might indicate overexposure to hazards; and

(vii) The contents of paragraphs (g) through (j) of the site safety and health plan set forth in paragraph (b)(4)(ii) of this section.

**(3) Initial training.**

(i) General site workers (such as equipment operators, general laborers and supervisory personnel) engaged in hazardous substance removal or other activities which expose or potentially expose workers to hazardous substances and health hazards shall receive a minimum of 40 hours of instruction off the site, and a minimum of three days actual field experience under the direct supervision of a trained, experienced supervisor.

(ii) Workers on site only occasionally for a specific limited task (such as, but not limited to, ground water monitoring, land surveying, or geo-physical surveying) and who are unlikely to be exposed over permissible exposure limits and published exposure limits shall receive a minimum of 24 hours of instruction off the site, and the minimum of one day actual field experience under the direct supervision of a trained, experienced supervisor.

(iii) Workers regularly on site who work in areas which have been monitored and fully characterized indicating that exposures are under permissible exposure limits and published exposure limits where respirators are not necessary, and the characterization indicates that there are no health hazards or the possibility of an emergency developing, shall receive a minimum of 24 hours of instruction off the site and the minimum of one day actual field experience under the direct supervision of a trained, experienced supervisor.

(iv) Workers with 24 hours of training who are covered by paragraphs (a)(3)(ii)and (a)(3)(iii) of this section, and who become general site workers or who are required to wear respirators, shall have the additional 16 hours and two days of training necessary to total the training specified in paragraph (e)(3)(i).

**(4) Management and supervisor training.** On-site management and supervisors directly responsible for, or who supervise employees engaged in, hazardous waste operations shall receive 40 hours initial training, and three days of supervised field experience (the training may be reduced to 24 hours and one day if the only area of their responsibility is employees covered by paragraphs (e)(3)(ii) and (e)(3)(iii) and at least eight additional hours of specialized training at the time of job assignment on such topics as, but not limited to, the employer's safety and health program and the associated employee training program, personal protective equipment program, spill containment program, and health hazard monitoring procedure and techniques.

**(5) Qualifications for trainers.** Trainers shall be qualified to instruct employees about the subject matter that is being presented in training. Such trainers shall have satisfactorily completed a training program for teaching the subjects they are expected to teach, or they shall have the academic credentials and instructional experience necessary for teaching the subjects. Instructors shall demonstrate competent instructional skills and knowledge of the applicable subject matter.

**(6) Training certification.** Employees and supervisors that have received and successfully completed the training and field experience specified in paragraphs (e)(1) through (e)(4) of this section shall be certified by their instructor or the head instructor and trained supervisor as having successfully completed the necessary training. A written certificate shall be given to each person so certified. Any person who has not been so certified or who does not meet the requirements of paragraph (e)(9) of this section shall be prohibited from engaging in hazardous waste operations.

**(7) Emergency response.** Employees who are engaged in responding to hazardous emergency situations at hazardous waste clean-up sites that may expose them to hazardous substances shall be trained in how to respond to such expected emergencies.

**(8) Refresher training.** Employees specified in paragraph (e)(1) of this section, and managers and supervisors specified in paragraph (e)(4) of this section, shall receive eight hours of refresher training annually on the items specified in paragraph (e)(2) and/or (e)(4) of this section, any critique of incidents that have occurred in the past year that can serve as training examples of related work, and other relevant topics.

**(9) Equivalent training.** Employers who can show by documentation or certification that an employee's work experience and/or training has resulted in training equivalent to that training required in paragraphs (e)(1) through (e)(4) of this section shall not be required to provide the initial training requirements of those paragraphs to such employees. However, certified employees new to a site shall receive appropriate, site specific training before site entry and have appropriate supervised field experience at the new site. Equivalent training includes any

academic training or the training that existing employees might have already received from actual hazardous waste site work experience.

**(f) Medical surveillance.**

(1) **General.** Employers engaged in operations specified in paragraphs (a)(1)(i) through (a)(1)(iv) of this section and not covered by (a)(2)(iii) exceptions and employers of employees specified in paragraph (g)(9) shall institute a medical surveillance program in accordance with this paragraph.

(2) **Employees covered.** The medical surveillance program shall be instituted by the employer for the following employees:

(i) All employees who are or may be exposed to hazardous substances or health hazards at or above the permissible exposure limits or, if there is no permissible exposure limit, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more a year;

(ii) All employees who wear a respirator for 30 days or more a year or as required by § 1910.134;

(iii) All employees who are injured due to overexposure from an emergency incident involving hazardous substances or health hazards; or

(iv) Members of HAZMAT teams.

(3) **Frequency of medical examinations and consultations.**

Medical examinations and consultations shall be made available by the employer to each employee covered under paragraph (f)(2) of this section on the following schedules:

(i) For employees covered under paragraphs (f)(2)(i), (f)(2)(ii), and (f)(2)(iv):

(a) Prior to assignment;

(b) At least once every twelve months for each employee covered unless the attending physician believes a longer interval (not greater than biennially) is appropriate;

(c) At termination of employment or reassignment to an area where the employee would not be covered if the employee has not had an examination within the last six months;

(d) As soon as possible upon notification by an employee that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards, or that the employee has been injured or exposed above the permissible exposure limits or published exposure levels in an emergency situation;

(e) At more frequent times, if the examining physician determines that an increased frequency of examination is medically necessary.

(ii) For employees covered under paragraph (f)(2)(iii) and for all employees including those of employers covered by paragraph (a)(1)(v) who may have been injured, received a health impairment, developed signs or symptoms which may have resulted from exposure to hazardous substances resulting from an emergency incident, or exposed during an emergency incident to hazardous substances at concentrations above the permissible exposure limits or the published exposure levels without the necessary personal protective equipment being used:

(a) As soon as possible following the emergency incident or development of signs or symptoms;

(b) At additional times, if the examining physician determines that follow-up examinations or consultations are medically necessary.

(4) **Content of medical examinations and consultations.**

(i) Medical examinations required by paragraph (f)(3) of this section shall include a medical and work history (or updated history if one is in the employee's file) with special emphasis on symptoms related to the handling of hazardous substances and health hazards, and to fitness for duty including the ability to wear any required PPE under conditions (i.e., temperature extremes) that may be expected at the work site.

(ii) The content of medical examinations or consultations made available to employees pursuant to paragraph (f) shall be determined by the attending physician. The guidelines in the *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* (See Appendix D, Reference #10) should be consulted.

**(5) Examination by a physician and costs.** All medical examinations and procedures shall be performed by or under the supervision of a licensed physician, preferably one knowledgeable in occupational medicine, and shall be provided without cost to the employee, without loss of pay, and at a reasonable time and place.

**(6) Information provided to the physician.** The employer shall provide one copy of this standard and its appendices to the attending physician, and in addition the following for each employee:

(i) A description of the employee's duties as they relate to the employee's exposures.

(ii) The employee's exposure levels or anticipated exposure levels.

(iii) A description of any personal protective equipment used or to be used.

(iv) Information from previous medical examinations of the employee which is not readily available to the examining physician.

(v) Information required by §1910.134.

**(7) Physician's written opinion.**

(i) The employer shall obtain and furnish the employee with a copy of a written opinion from the attending physician containing the following:

(a) The physician's opinion as to whether the employee has any detected medical conditions which would place the employee at increased risk of material impairment of the employee's health from work in hazardous waste operations or emergency response, or from respirator use.

(b) The physician's recommended limitations upon the employee's assigned work.

(c) The results of the medical examination and tests if requested by the employee.

(d) A statement that the employee has been informed by the physician of the results of the medical examination and any medical conditions which require further examination or treatment.

(ii) The written opinion obtained by the employer shall not reveal specific findings or diagnoses unrelated to occupational exposures.

**(8) Recordkeeping.**

(i) An accurate record of the medical surveillance required by paragraph (f) of this section shall be retained. This record shall be retained for the period specified and meet the criteria of 29 CFR 1910.20.

(ii) The record required in paragraph (f)(8)(i) of this section shall include at least the following information:

(a) The name and social security number of the employee;

(b) Physician's written opinions, recommended limitations, and results of examinations and tests;

(c) Any employee medical complaints related to exposure to hazardous substances;

(d) A copy of the information provided to the examining physician by the employer, with the exception of the standard and its appendices.

**(g) Engineering controls, work practices, and personal protective equipment for employee protection.**

Engineering controls, work practices, personal protective equipment, or a combination of these shall be implemented in accordance with this paragraph to protect employees from exposure to hazardous substances and safety and health hazards.

**(1) Engineering controls, work practices and PPE for substances regulated in Subparts G and Z.**

(i) Engineering controls and work practices shall be instituted to reduce and maintain employee exposure to or below the permissible exposure limits for substances regulated by 29 CFR Part 1910, to the extent required by Subpart Z, except to the extent that such controls and practices are not feasible.

**Note to (g)(1)(i):** Engineering controls which may be feasible include the use of pressurized cabs or control booths on equipment, and/or the use of remotely operated material handling equipment. Work practices which may be feasible are removing all non-essential employees from potential exposure during opening of drums, wetting down dusty operations and locating employees upwind of possible hazards.

(ii) Whenever engineering controls and work practices are not feasible, PPE shall be used to reduced and maintain employee exposures to or below the permissible exposure limits or dose limits for substances regulated by 29 CFR Part 1910, Subpart Z.

(iii) The employer shall not implement a schedule of employee rotation as a means of compliance with permissible exposure limits or dose limits except when there is no other feasible way of complying with the airborne or dermal dose limits for ionizing radiation.

(iv) The provisions of 29 CFR, Subpart G, shall be followed.

**(2) Engineering controls, work practices, and PPE for substances not regulated in Subparts G and Z.** An appropriate combination of engineering controls, work practices and personal protective equipment shall be used to reduce and maintain employee exposure to or below published exposure levels for hazardous substances and health hazards not regulated by 29 CFR Part 1910, Subparts G and Z. The employer may use the published literature and MSDS as a guide in making the employer's determination as to what level of protection the employer believes is appropriate for hazardous substances and health hazards for which there is no permissible exposure limit or published exposure limit.

**(3) Personal protective equipment selection.**

(i) Personal protective equipment (PPE) shall be selected and used which will protect employees from the hazards and potential hazards they are likely to encounter as identified during the site characterization and analysis.

(ii) Personal protective equipment selection shall be based on an evaluation of the performance characteristics of the PPE relative to the requirements and limitations of the site, the task-specific conditions and duration, and the hazards and potential hazards identified at the site.

(iii) Positive pressure self-contained breathing apparatus, or positive pressure air-line respirators equipped with an escape air supply, shall be used when chemical exposure levels present will create a substantial possibility of immediate death, immediate serious illness or injury, or impair the ability to escape.

(iv) Totally-encapsulating chemical protective suits (protection equivalent to Level A protection as recommended in Appendix B) shall be used in conditions where skin absorption of a hazardous substance may result in a substantial possibility of immediate death, immediate serious illness or injury, or impair the ability to escape.

(v) The level of protection provided by PPE selection shall be increased when additional information on site conditions indicates that increased protection is necessary to reduce employee exposures below permissible exposure limits and published exposure levels for hazardous substances and health hazards. (See Appendix B for guidance on selecting PPE ensembles.)

**Note to (g)(3):** The level of employee protection provided may be decreased when additional information or site conditions show that decreased protection will not result in hazardous exposures to employees.

(vi) Personal protective equipment shall be selected and used to meet the requirements of 29 CFR Part 1910, Subpart I, and additional requirements specified in this section.

(4) **Totally-encapsulating chemical protective suits.**

(i) Totally-encapsulating suits shall protect employees from the particular hazards which are identified during site characterization and analysis.

(ii) Totally-encapsulating suits shall be capable of maintaining positive air pressure. (See Appendix A for a test method which may be used to evaluate this requirement.)

(iii) Totally-encapsulating suits shall be capable of preventing inward test gas leakage of more than 0.5 percent. (See Appendix A for a test method which may be used to evaluate this requirement.)

(5) **Personal protective equipment (PPE) program.** A written personal protective equipment program, which is part of the employer's safety and health program required in paragraph (b) of this section or required in paragraph (p)(1) of this section and which is also a part of the site-specific safety and health plan shall be established. The PPE program shall address the elements listed below. When elements, such as donning and doffing procedures, are provided by the manufacturer of a piece of equipment and are attached to the plan, they need not be rewritten into the plan as long as they adequately address the procedure or element.

(i) PPE selection based upon site hazards,

(ii) PPE use and limitations of the equipment,

(iii) Work mission duration,

(iv) PPE maintenance and storage,

(v) PPE decontamination and disposal,

(vi) PPE training and proper fitting,

(vii) PPE donning and doffing procedures,

(viii) PPE inspection procedures prior to, during, and after use,

(ix) Evaluation of the effectiveness of the PPE program, and

(x) Limitations during temperature extremes, heat stress, and other appropriate medical considerations.

(h) Monitoring.

(1) **General.**

(i) Monitoring shall be performed in accordance with this paragraph where there may be a question of employee exposure to hazardous concentrations of hazardous substances in order to assure proper selection of engineering controls, work practices and personal protective equipment so that employees are not exposed to levels which exceed permissible exposure limits or published exposure levels for hazardous substances.

(ii) Air monitoring shall be used to identify and quantify airborne levels of hazardous substances and safety and health hazards in order to determine the appropriate level of employee protection needed on site.

(2) **Initial entry.** Upon initial entry, representative air monitoring shall be conducted to identify any IDLH condition, exposure over permissible exposure limits or published exposure levels, exposure over a radioactive material's dose limits or other dangerous condition such as the presence of flammable atmospheres or oxygen-deficient environments.

(3) **Periodic monitoring.** Periodic monitoring shall be conducted when the possibility of an IDLH condition or flammable atmosphere has developed or when there is indication that exposures may have risen over permissible exposure limits or published exposure levels since prior monitoring. Situations where it shall be considered whether the possibility that exposures have risen are as follows:

(i) When work begins on a different portion of the site.

(ii) When contaminants other than those previously identified are being handled.

(iii) When a different type of operation is initiated (e.g., drum opening as opposed to exploratory well drilling).

(iv) When employees are handling leaking drums or containers or working in areas with obvious liquid contamination (e.g., a spill or lagoon).

(4) **Monitoring of high-risk employees.** After the actual clean-up phase of any hazardous waste

operation commences; for example, when soil, surface water or containers are moved or disturbed; the employer shall monitor those employees likely to have the highest exposure to hazardous substances and health hazards likely to be present above permissible exposure limits or published exposure levels by using personal sampling frequently enough to characterize employee exposures. If the employees likely to have the highest exposure are over permissible exposure limits or published exposure limits, then monitoring shall continue to determine all employees likely to be above those limits. The employer may utilize a representative sampling approach by documenting that the employees and chemicals chosen for monitoring are based on the criteria stated above.

**Note to (h):** It is not required to monitor employees engaged in site characterization operations covered by paragraph (c) of this section.

### (i) Informational programs.

Employers shall develop and implement a program, which is part of the employer's safety and health program required in paragraph (b) of this section, to inform employees, contractors, and subcontractors (or their representative) actually engaged in hazardous waste operations of the nature, level and degree of exposure likely as a result of participation in such hazardous waste operations. Employees, contractors and subcontractors working outside of the operations part of a site are not covered by this standard.

### (j) Handling drums and containers.

**(1) General.**

(i) Hazardous substances and contaminated soils, liquids, and other residues shall be handled, transported, labeled, and disposed of in accordance with this paragraph.

(ii) Drums and containers used during the clean-up shall meet the appropriate DOT, OSHA, and EPA regulations for the wastes that they contain.

(iii) When practical, drums and containers shall be inspected and their integrity shall be assured prior to being moved. Drums or containers that cannot be inspected before being moved because of storage conditions (i.e., buried beneath the earth, stacked behind other drums, stacked several tiers high in a pile, etc.) shall be moved to an accessible location and inspected prior to further handling.

(iv) Unlabeled drums and containers shall be considered to contain hazardous substances and handled accordingly until the contents are positively identified and labeled.

(v) Site operations shall be organized to minimize the amount of drum or container movement.

(vi) Prior to movement of drums or containers, all employees exposed to the transfer operation shall be warned of the potential hazards associated with the contents of the drums or containers.

(vii) U.S. Department of Transportation specified salvage drums or containers and suitable quantities of proper absorbent shall be kept available and used in areas where spills, leaks, or ruptures may occur.

(viii) Where major spills may occur, a spill containment program, which is part of the employer's safety and health program required in paragraph (b) of this section, shall be implemented to contain and isolate the entire volume of the hazardous substance being transferred.

(ix) Drums and containers that cannot be moved without rupture, leakage, or spillage shall be emptied into a sound container using a device classified for the material being transferred.

(x) A ground-penetrating system or other type of detection system or device shall be used to estimate the location and depth of buried drums or containers.

(xi) Soil or covering material shall be removed with caution to prevent drum or container rupture.

(xii) Fire extinguishing equipment meeting the requirements of 29 CFR Part 1910, Subpart L, shall be on hand and ready for use to control incipient fires.

**(2) Opening drums and containers.** The following procedures shall be followed in areas where drums or containers are being opened:

(i) Where an airline respirator system is used, connections to the source of air supply shall be protected from contamination and the entire system shall be protected from physical damage.

(ii) Employees not actually involved in opening drums or containers shall be kept a safe distance from the drums or containers being opened.

(iii) If employees must work near or adjacent to drums or containers being opened, a suitable shield that does not interfere with the work operation shall be placed between the employee and the drums or containers being opened to protect the employee in case of accidental explosion.

(iv) Controls for drum or container opening equipment, monitoring equipment, and fire suppression equipment shall be located behind the explosion-resistant barrier.

(v) When there is a reasonable possibility of flammable atmospheres being present, material handling equipment and hand tools shall be of the type to prevent sources of ignition.

(vi) Drums and containers shall be opened in such a manner that excess interior pressure will be safety relieved. If pressure can not be relieved from a remote location, appropriate shielding shall be placed between the employee and the drums or containers to reduce the risk of employee injury.

(vii) Employees shall not stand upon or work from drums or containers.

(3) **Material handling equipment.** Material handling equipment used to transfer drums and containers shall be selected, positioned and operated to minimize sources of ignition related to the equipment from igniting vapors released from ruptured drums or containers.

(4) **Radioactive wastes.** Drums and containers containing radioactive wastes shall not be handled until such time as their hazard to employees is properly assessed.

(5) **Shock sensitive wastes.** As a minimum, the following special precautions shall be taken when drums and containers containing or suspected of containing shock-sensitive wastes are handled:

(i) All non-essential employees shall be evacuated from the area of transfer.

(ii) Material handling equipment shall be provided with explosive containment devices or protective shields to protect equipment operators from exploding containers.

(iii) An employee alarm system capable of being perceived above surrounding light and noise conditions shall be used to signal the commencement and completion of explosive waste handling activities.

(iv) Continuous communications (i.e., portable radios, hand signals, telephones, as appropriate) shall be maintained between the employee-in-charge of the immediate handling area and both the site safety and health supervisor and the command post until such time as the handling operation is completed. Communication equipment or methods that could cause shock sensitive materials to explode shall not be used.

(v) Drums and containers under pressure, as evidenced by bulging or swelling, shall not be moved until such time as the cause for excess pressure is determined and appropriate containment procedures have been implemented to protect employees from explosive relief of the drum.

(vi) Drums and containers containing packaged laboratory wastes shall be considered to contain shock-sensitive or explosive materials until they have been characterized.

**Caution:** Shipping of shock sensitive wastes may be prohibited under U.S. Department of Transportation regulations. Employers and their shippers should refer to 49 CFR 173.21 and 173.50.

(6) **Laboratory waste packs.** In addition to the requirements of paragraph (j)(5) of this section, the following precautions shall be taken, as a minimum, in handling laboratory waste packs (lab packs):

(i) Lab packs shall be opened only when necessary and then only by an individual knowledgeable in the inspection, classification, and segregation of the containers within the pack according to the hazards of the wastes.

(ii) If crystalline material is noted on any con-

tainer, the contents shall be handled as a shock-sensitive waste until the contents are identified.

**(7) Sampling of drum and container contents.** Sampling of containers and drums shall be done in accordance with a sampling procedure which is part of the site safety and health plan developed for and available to employees and others at the specific worksite.

**(8) Shipping and transport.**

(i) Drums and containers shall be identified and classified prior to packaging for shipment.

(ii) Drum or container staging areas shall be kept to the minimum number necessary to identify and classify materials safely and prepare them for transport.

(iii) Staging areas shall be provided with adequate access and egress routes.

(iv) Bulking of hazardous wastes shall be permitted only after a thorough characterization of the materials has been completed.

**(9) Tank and vault procedures.**

(i) Tanks and vaults containing hazardous substances shall be handled in a manner similar to that for drums and containers, taking into consideration the size of the tank or vault.

(ii) Appropriate tank or vault entry procedures as described in the employer's safety and health plan shall be followed whenever employees must enter a tank or vault.

## (k) Decontamination.

**(1) General.** Procedures for all phases of decontamination shall be developed and implemented in accordance with this paragraph.

**(2) Decontamination procedures.**

(i) A decontamination procedure shall be developed, communicated to employees and implemented before any employees or equipment may enter areas on site where potential for exposure to hazardous substances exists.

(ii) Standard operating procedures shall be developed to minimize employee contact with hazardous substances or with equipment that has contacted hazardous substances.

(iii) All employees leaving a contaminated area shall be appropriately decontaminated; all contaminated clothing and equipment leaving a contaminated area shall be appropriately disposed of or decontaminated.

(iv) Decontamination procedures shall be monitored by the site safety and health supervisor to determine their effectiveness. When such procedures are found to be ineffective, appropriate steps shall be taken to correct any deficiencies.

**(3) Location.** Decontamination shall be performed in geographical areas that will minimize the exposure of uncontaminated employees or equipment to contaminated employees or equipment.

**(4) Equipment and solvents.** All equipment and solvents used for decontamination shall be decontaminated or disposed of properly.

**(5) Personal protective clothing and equipment.**

(i) Protective clothing and equipment shall be decontaminated, cleaned, laundered, maintained or replaced as needed to maintain their effectiveness.

(ii) Employees whose non-impermeable clothing becomes wetted with hazardous substances shall immediately remove that clothing and proceed to shower. The clothing shall be disposed of or decontaminated before it is removed from the work zone.

**(6) Unauthorized employees.** Unauthorized employees shall not remove protective clothing or equipment from change rooms.

**(7) Commercial laundries or cleaning establishments.** Commercial laundries or cleaning establishments that decontaminate protective clothing or equipment shall be informed of the potentially harmful effects of exposures to hazardous substances.

**(8) Showers and change rooms.** Where the decontamination procedure indicates a need for regular showers and change rooms outside of a

contaminated area, they shall be provided and meet the requirements of 29 CFR 1910.141. If temperature conditions prevent the effective use of water, then other effective means for cleansing shall be provided and used.

## (l) Emergency response by employees at uncontrolled hazardous waste sites.

**(1) Emergency response plan.**

(i) An emergency response plan shall be developed and implemented by all employers within the scope of this section to handle anticipated emergencies prior to the commencement of hazardous waste operations. The plan shall be in writing and available for inspection and copying by employees, their representatives, OSHA personnel and other governmental agencies with relevant responsibilities.

(ii) Employers who will evacuate their employees from the workplace when an emergency occurs, and who do not permit any of their employees to assist in handling the emergency, are exempt from the requirements of this paragraph if they provide an emergency action plan complying with section 1910.38(a) of this part.

**(2) Elements of an emergency response plan.** The employer shall develop an emergency response plan for emergencies which shall address, as a minimum the following:

(i) Pre-emergency planning.

(ii) Personnel roles, lines of authority, and communication.

(iii) Emergency recognition and prevention.

(iv) Safe distances and places of refuge.

(v) Site security and control.

(vi) Evacuation routes and procedures.

(vii) Decontamination procedures which are not covered by the site safety and health plan.

(viii) Emergency medical treatment and first aid.

(ix) Emergency alerting and response procedures.

(x) Critique of response and follow-up.

(xi) PPE and emergency equipment.

**(3) Procedures for handling emergency incidents.**

(i) In addition to the elements for the emergency response plan required in paragraph (1)(2) of this section, the following elements shall be included for emergency response plans:

(a) Site topography, layout, and prevailing weather conditions.

(b) Procedures for reporting incidents to local, state, and federal governmental agencies.

(ii) The emergency response plan shall be a separate section of the Site Safety and Health Plan.

(iii) The emergency response plan shall be compatible and integrated with the disaster, fire and/or emergency response plans of local, state, and federal agencies.

(iv) The emergency response plan shall be rehearsed regularly as part of the overall training program for site operations.

(v) The site emergency response plan shall be reviewed periodically and, as necessary, be amended to keep it current with new or changing site conditions or information.

(vi) An employee alarm system shall be installed in accordance with 29 CFR 1910.165 to notify employees of an emergency situation: to stop work activities if necessary; to lower background noise in order to speed communication; and to begin emergency procedures.

(vii) Based upon the information available at time of the emergency, the employer shall evaluate the incident and the site response capabilities and proceed with the appropriate steps to implement the site emergency response plan.

### (m) Illumination.

Areas accessible to employees shall be lighted to not less than the minimum illumination intensities listed in the following Table H-120.1 while any work is in progress:

TABLE H-120.1—MINIMUM ILLUMINATION INTENSITIES IN FOOT-CANDLES

| Foot-candles | Area or operations |
|---|---|
| 5 ..... | General site areas. |
| 3 ..... | Excavation and waste areas, accessways, active storage areas, loading platforms, refueling, and field maintenance areas. |
| 5 ..... | Indoors: Warehouses, corridors, hallways, and exitways. |
| 5 ..... | Tunnels, shafts, and general underground work areas. (Exception: Minimum of 10 foot-candles is required at tunnel and shaft heading during drilling mucking, and scaling. Mine Safety and Health Administration approved cap lights shall be acceptable for use in the tunnel heading). |
| 10 ..... | General shops (e.g., mechanical and electrical equipment rooms, active storerooms, barracks or living quarters, locker or dressing rooms, dining areas, and indoor toilets and workrooms.) |
| 30 ..... | First aid stations, infirmaries, and offices. |

### (n) Sanitation at temporary workplaces.

**(1) Potable water.**

(i) An adequate supply of potable water shall be provided on the site.

(ii) Portable containers used to dispense drinking water shall be capable of being tightly closed, and equipped with a tap. Water shall not be dipped from containers.

(iii) Any container used to distribute drinking water shall be clearly marked as to the nature of its contents and not used for any other purpose.

(iv) Where single service cups (to be used but once) are supplied, both a sanitary container for the unused cups and a receptacle for disposing of the used cups shall be provided.

**(2) Nonpotable water.**

(i) Outlets for nonpotable water, such as water for firefighting purposes, shall be identified to indicate clearly that the water is unsafe and is not to be used for drinking, washing, or cooking purposes.

(ii) There shall be no cross-connection, open or potential, between a system furnishing potable water and a system furnishing nonpotable water.

**(3) Toilet facilities.**

(i) Toilets shall be provided for employees according to the following Table H-120.2.

TABLE H-120.2—TOILET FACILITIES

| Number of employees | Minimum number of facilities |
|---|---|
| 20 or fewer ..... | One. |
| More than 20, fewer than 200. | One toilet seat and one urinal per 40 employees. |
| More than 200 ..... | One toilet seat and one urinal per 50 employees. |

(ii) Under temporary field conditions, provisions shall be made to assure that at least one toilet facility is available.

(iii) Hazardous waste sites not provided with a sanitary sewer shall be provided with the following toilet facilities unless prohibited by local codes:

(a) Chemical toilets;

(b) Recirculating toilets;

(c) Combustion toilets; or

(d) Flush toilets.

(iv) The requirements of this paragraph for sanitation facilities shall not apply to mobile crews having transportation readily available to nearby toilet facilities.

(v) Doors entering toilet facilities shall be provided with entrance locks controlled from inside the facility.

**(4) Food handling.** All food service facilities and operations for employees shall meet the applicable laws, ordinances, and regulations of the jurisdictions in which they are located.

**(5) Temporary sleeping quarters.** When temporary sleeping quarters are provided, they shall be heated, ventilated, and lighted.

**(6) Washing facilities.** The employer shall provide adequate washing facilities for employees engaged in operations where hazardous substances may be harmful to employees. Such facilities shall be in near proximity to the worksite; in areas where exposures are below permissible exposure limits and published exposure levels and which are under the controls of the employer; and shall be so equipped as to enable employees to remove hazardous substances from themselves.

**(7) Showers and change rooms.** When hazardous waste clean-up or removal operations commence on a site and the duration of the work will require six months or greater time to complete, the employer shall provide showers and change rooms for all employees exposed to hazardous substances and health hazards involved in hazardous waste clean-up or removal operations.

(i) Showers shall be provided and shall be provided and shall meet the requirements of 29 CFR 1910.141(d)(3).

(ii) Change rooms shall be provided and shall meet the requirements of 29 CFR 1910.141(e). Change rooms shall consist of two separate change areas separated by the shower area required in paragraph (n)(7)(i) of this section. One change area, with an exit leading off the worksite, shall provide employees with a clean area where they can remove, store, and put on street clothing. The second area, with an exit to the worksite, shall provide employees with an area where they can put on, remove and store work clothing and personal protective equipment.

(iii) Showers and change rooms shall be located in areas where exposures are below the permissible exposure limits and published exposure levels. If this cannot be accomplished, then a ventilation system shall be provided that will supply air that is below the permissible exposure limits and published exposure levels.

(iv) Employers shall assure that employees shower at the end of their work shift and when leaving the hazardous waste site.

## (o) New technology programs.

(1) The employer shall develop and implement procedures for the introduction of effective new technologies and equipment developed for the improved protection of employees working with hazardous waste clean-up operations, and the same shall be implemented as part of the site safety and health program to assure that employee protection is being maintained.

(2) New technologies, equipment or control measures available to the industry, such as the use of foams, absorbents, adsorbents, neutralizers, or other means to suppress the level of air contaminants while excavating the site or for spill control, shall be evaluated by employers or their representatives. Such an evaluation shall be done to determine the effectiveness of the new methods, materials, or equipment before implementing their use on a large scale for enhancing employee protection. Information and data from manufacturers or suppliers may be used as part of the employer's evaluation effort. Such evaluations shall be made available to OSHA upon request.

## (p) Certain Operations Conducted Under the Resource Conservation and Recovery Act of 1976 (RCRA).

Employers conducting operations at treatment, storage, and disposal (TSD) facilities specified in paragraph (a)(1)(iv) of this section not exempted by paragraph (a)(2)(iii) of this section shall provide and implement the programs specified in this paragraph.

**(1) Safety and health program.** The employer shall develop and implement a written safety and health program for employees involved in hazardous waste operations that shall be available for inspection by employees, their representatives and OSHA personnel. The program shall be designed to identify, evaluate and control safety and health hazards in their facilities

for the purpose of employee protection, to provide for emergency response meeting the requirements of paragraph (p)(8) of this section and to address as appropriate site analysis, engineering controls, maximum exposure limits, hazardous waste handling procedures and uses of new technologies.

**(2) Hazard communication program.** The employer shall implement a hazard communication program meeting the requirements of 29 CFR 1910.1200 as part of the employer's safety and program.

**Note to 1910.120.**—The exemption for hazardous waste provided in §1910.1200 is applicable to this section.

**(3) Medical surveillance program.** The employer shall develop and implement a medical surveillance program meeting the requirements of paragraph (f) of this section.

**(4) Decontamination program.** The employer shall develop and implement a decontamination procedure meeting the requirements of paragraph (k) of this section.

**(5) New technology program.** The employer shall develop and implement procedures meeting the requirements of paragraph (o) of this section for introducing new and innovative equipment into the workplace.

**(6) Material handling program.** Where employees will be handling drums or containers, the employer shall develop and implement procedures meeting the requirements of paragraphs (j)(1)(ii) through (viii) and (xi) of this section, as well as (j)(3) and (j)(8) of this section prior to starting such work.

**(7) Training program.**

**(i) New employees.** The employer shall develop and implement a training program, which is part of the employer's safety and health program, for employees involved with hazardous waste operations to enable employees to perform their assigned duties and functions in a safe and healthful manner so as not to endanger themselves or other employees. The initial training shall be for 24 hours and refresher training shall be for eight hours annually. Employees who have received the initial training required by this paragraph shall be given a written certificate attesting that they have successfully completed the necessary training.

**(ii) Current employees.** Employers who can show by an employee's previous work experience and/or training that the employee has had training equivalent to the initial training required by this paragraph, shall be considered as meeting the initial training requirements of this paragraph as to that employee. Equivalent training includes the training that existing employees might have already received from actual site work experience. Current employees shall receive eight hours of refresher training annually.

**(iii) Trainers.** Trainers who teach initial training shall have satisfactorily completed a training course for teaching the subjects they are expected to teach or they shall have the academic credentials and instruction experience necessary to demonstrate a good command of the subject matter of the courses and competent instructional skills.

**(8) Emergency response program.**

**(i) Emergency response plan.** An emergency response plan shall be developed and implemented by all employers. Such plans need not duplicate any of the subjects fully addressed in the employer's contingency planning required by permits, such as those issued by the U.S. Environmental Protection Agency, provided that the contingency plan is made part of the emergency response plan shall be a written portion of the employers safety and health program required in paragraph (p)(1) of this section. Employers who will evacuate their employees from the worksite location when an emergency occurs and who do not permit any of their employees to assist in handling the emergency are exempt from the requirements of paragraph (p)(8) if they provide an emergency action plan complying with §1910.38(a) of this part.

**(ii) Elements of an emergency response plan.** The employer shall develop an emergency response plan for emergencies which shall address, as a minimum, the following areas to the extent that they are not addressed in any specific program required in this paragraph:

(a) Pre-emergency planning and coordination with outside parties.

(b) Personnel roles, lines of authority, and communication.

(c) Emergency recognition and prevention.

(d) Safe distances and places of refuge.

(e) Site security and control.

(f) Evacuation routes and procedures.

(g) Decontamination procedures.

(h) Emergency medical treatment and first aid.

(i) Emergency alerting and response procedures.

(j) Critique of response and follow-up.

(k) PPE and emergency equipment.

**(iii) Training.**

(a) Training for emergency response employees shall be completed before they are called upon to perform in real emergencies. Such training shall include the elements of the emergency response plan, standard operating procedures the employer has established for the job, the personal protective equipment to be worn and procedures for handling emergency incidents.

**Exception #1:** An employer need not train all employees to the degree specified if the employer divides the work force in a manner such that a sufficient number of employees who have responsibility to control emergencies have the training specified, and all other employees, who may first respond to an emergency incident, have sufficient awareness training to recognize that an emergency response situation exists and that they are instructed in that case to summon the fully trained employees and not attempt control activities for which they are not trained.

**Exception #2:** An employer need not train all employees to the degree specified if arrangements have been made in advance for an outside fully-trained emergency response team to respond in a reasonable period and all employees, who may come to the incident first, have sufficient awareness training to recognize that an emergency response situation exists and they have been instructed to call the designated outside fully-trained emergency response team for assistance.

(b) Employee members of TSD facility emergency response organizations shall be trained to a level of competence in the recognition of health and safety hazards to protect themselves and other employees. This would include training in the methods used to minimize the risk from safety and health hazards; in the safe use of control equipment; in the selection and use of appropriate personal protective equipment; in the safe operating procedures to be used at the incident scene; in the techniques of coordination with other employees to minimize risks; in the appropriate response to over exposure from health hazards or injury to themselves and other employees; and in the recognition of subsequent symptoms which may result from over exposures.

(c) The employer shall certify that each covered employee has attended and successfully completed the training required in paragraph (p)(8)(iii) of this section, or shall certify the employee's competency at least yearly. The method used to demonstrate competency for certification of training shall be recorded and maintained by the employer.

**(iv) Procedures for handling emergency incidents.**

(a) In addition to the elements for the emergency response plan required in paragraph (p)(8)(ii) of this section, the following elements shall be included for emergency response plans to the extent that they do not repeat any information already contained in the emergency response plan:

(1) Site topography, layout, and prevailing weather conditions.

(2) Procedures for reporting incidents to local, state, and federal governmental agencies.

(b) The emergency response plan shall be compatible and integrated with the disas-

ter, fire and/or emergency response plans of local, state, and federal agencies.

(c) The emergency response plan shall be rehearsed regularly as part of the overall training program for site operations.

(d) The site emergency response plan shall be reviewed periodically and, as necessary, be amended to keep it current with new or changing site conditions or information.

(e) An employee alarm system shall be installed in accordance with 29 CFR 1910.165 to notify employees of an emergency situation; to stop work activities if necessary; to lower background noise in order to speed communication; and to begin emergency procedures.

(f) Based upon the information available at time of the emergency, the employer shall evaluate the incident and the site response capabilities and proceed with the appropriate steps to implement the site emergency response plan.

## (q) Emergency response to hazardous substance releases.

This paragraph covers employers whose employees are engaged in emergency response no matter where it occurs except that it does not cover employees engaged in operations specified in paragraphs (a)(1)(i) through (a)(1)(iv) of this section. Those emergency response organizations who have developed and implemented programs equivalent to this paragraph for handling releases of hazardous substances pursuant to section 303 of the Superfund Amendments and Reauthorization Act of 1986 (Emergency Planning and Community Right-to-Know Act of 1986, 42 U.S.C. 11003) shall be deemed to have met the requirements of this paragraph.

(1) **Emergency response plan.** An emergency response plan shall be developed and implemented to handle anticipated emergencies prior to the commencement of emergency response operations. The plan shall be in writing and available for inspection and copying by employees, their representatives and OSHA personnel. Employers who will evacuate their employees from the workplace when an emergency occurs, and who do not permit any of their employees to assist in handling the emergency, are exempt from the requirements of this paragraph if they provide an emergency action plan in accordance with §1910.38(a) of this part.

(2) **Elements of an emergency response plan.** The employer shall develop an emergency response plan for emergencies which shall address, as a minimum, the following to the extent that they are not addressed elsewhere:

(i) Pre-emergency planning and coordination with outside parties.

(ii) Personnel roles, lines of authority, training, and communication.

(iii) Emergency recognition and prevention.

(iv) Safe distances and places of refuse.

(v) Site security and control.

(vi) Evacuation routes and procedures.

(vii) Decontamination.

(viii) Emergency medical treatment and first aid.

(ix) Emergency alerting and response procedures.

(x) Critique of response and follow-up.

(xi) PPE and Emergency equipment.

(xii) Emergency response organizations may use the local emergency response plan or the state emergency response plan or both, as part of their emergency response plan to avoid duplication. Those items of the emergency response plan that are being properly addressed by the SARA Title III plans may be substituted into their emergency plan or otherwise kept together for the employer and employee's use.

(3) ***Procedures for handling emergency response.***

(i) The senior emergency response official responding to an emergency shall become the individual in charge of a site-specific Incident Command System (ICS). All emergency responders and their communications shall be coordinated and controlled through the individual in charge of the ICS assisted by the senior official present for each employer.

**Note to (q)(3)(i).**—The "senior official" at an emergency response is the most senior official on the site who has the responsibility for controlling the operations at the site. Initially it is the senior officer on the first-due piece of responding emergency apparatus to arrived on the incident scene. As more senior officers arrive (i.e., battalion chief, fire chief, state law enforcement official, site coordinator, etc.) the position is passed up the line of authority which has been previously established.

(ii) The individual in charge of the ICS shall identify, to the extent possible, all hazardous substances or conditions present and shall address as appropriate site analysis, use of engineering controls, maximum exposure limits, hazardous substance handling procedures, and use of any new technologies.

(iii) Based on the hazardous substances and/or conditions present, the individual in charge of the ICS shall implement appropriate emergency operations, and assure that the personal protective equipment worn is appropriate for the hazards to be encountered. However, personal protective equipment shall meet, at a minimum, the criteria contained in 29 CFR 1910.156(e) when worn while performing fire fighting operations beyond the incipient stage for any incident or site.

(iv) Employees engaged in emergency response and exposed to hazardous substances presenting an inhalation hazard or potential inhalation hazard shall wear positive pressure self-contained breathing apparatus while engaged in emergency response, until such time that the individual in charge of the ICS determines through the use of air monitoring that a decreased level of respiratory protection will not result in hazardous exposures to employees.

(v) The individual in charge of the ICS shall limit the number of emergency response personnel at the emergency site, in those areas of potential or actual exposure to incident or site hazards, to those who are actively performing emergency operations. However, operations in hazardous areas shall be performed using the buddy system in groups of two or more.

(vi) Back-up personnel shall stand by with equipment ready to provide assistance or rescue. Advance first aid support personnel, as a minimum, shall also stand by with medical equipment and transportation capability.

(vii) The individual in charge of the ICS shall designate a safety official, who is knowledgeable in the operations being implemented at the emergency response site, with specific responsibility to identify and evaluate hazards and to provide direction with respect to the safety of operations for the emergency at hand.

(viii) When activities are judged by the safety official to be an IDLH condition and/or to involve an imminent danger condition, the safety official shall have the authority to alter, suspend, or terminate those activities. The safety official shall immediately inform the individual in charge of the ICS of any actions needed to be taken to correct these hazards at an emergency scene.

(ix) After emergency operations have terminated, the individual in charge of the ICS shall implement appropriate decontamination procedures.

(x) When deemed necessary for meeting the tasks at hand, approved self-contained compressed air breathing apparatus may be used with approved cylinders from other approved self-contained compressed air breathing apparatus provided that such cylinders are of the same capacity and pressure rating. All compressed air cylinders used with self-contained breathing apparatus shall meet U.S. Department of Transportation and National Institute for Occupational Safety and Health criteria.

**(4) Skilled support personnel.** Personnel, not necessarily an employer's own employees, who are skilled in the operation of certain equipment, such as mechanized earth moving or digging equipment or crane and hoisting equipment, and who are needed temporarily to perform immediate emergency support work that cannot reasonably be performed in a timely fashion by an employer's own employees, and who will be or may be exposed to the hazards at an emergency response scene, are not required to meet the training required in this paragraph for the employer's regular employees. However, these personnel shall be given an initial briefing at the site prior to their participation in any emergency response. The initial briefing shall

include instruction in the wearing of appropriate personal protective equipment, what chemical hazards are involved, and what duties are to be performed. All other appropriate safety and health precautions provided to the employer's own employees shall be used to assure the safety and health of these personnel.

(5) **Specialist employees.** Employees who, in the course of their regular job duties, work with and are trained in the hazards of specific hazardous substances, and who will be called upon to provide technical advice or assistance at a hazardous substance release incident to the individual in charge, shall receive training or demonstrate competency in the area of their specialization annually.

(6) **Training.** Training shall be based on the duties and function to be performed by each responder of an emergency response organization. The skill and knowledge levels required for all new responders, those hired after the effective date of this standard, shall be conveyed to them through training before they are permitted to take part in actual emergency operations on an incident. Employees who participate, or are expected to participate, in emergency response, shall be given training in accordance with the following paragraphs:

(i) **First responder awareness level.** First responders at the awareness level are individuals who are likely to witness or discover a hazardous substance release and who have been trained to initiate an emergency response sequence by notifying the proper authorities of the release. They would take no further action beyond notifying the authorities of the release. First responders at the awareness level shall have sufficient training to have had sufficient experience to objectively demonstrate competency in the following areas.

(a) An understanding of what hazardous materials are, and the risks associated with them in an incident.

(b) An understanding of the potential outcomes associated with an emergency created when hazardous materials are present.

(c) The ability to recognize the presence of hazardous materials in an emergency.

(d) The ability to identify the hazardous materials, if possible.

(e) An understanding of the role of the first responder awareness individual in the employer's emergency response plan including the site security and control and the U.S. Department of Transportation's Emergency Response Guidebook.

(f) The ability to realize the need for additional resources, and to make appropriate notifications to the communication center.

(ii) **First responder operations level.** First responders at the operations level are individuals who respond to releases or potential releases of hazardous substances as part of the initial response to the site for the purpose of protecting nearby persons, property, or the environment from the effects of the release. They are trained to respond in a defensive fashion without actually trying to stop the release. Their function is to contain the release from a safe distance, keep it from spreading, and prevent exposures. First responders at the operational level shall have received at least eight hours of training or have had sufficient experience to objectively demonstrate competency in the following areas in addition to those listed for the awareness level and the employer shall so certify:

(a) Knowledge of the basic hazard and risk assessment techniques.

(b) Know how to select and use proper personal protective equipment provided to the first responder operational level.

(c) An understanding of basic hazardous materials terms.

(d) Know how to perform basic control, containment and/or confinement operations within the capabilities of the resources and personal protective equipment available with their unit.

(e) Know how to implement basic decontamination procedures.

(f) An understanding of the relevant standard operating procedures and termination procedures.

(iii) **Hazardous materials technician.** Hazardous materials technicians are individuals who respond to releases or potential releases for the purpose of stopping the release. They assume a more aggressive role than a first responder at the operations level in that they will approach the point of release in order to plug, patch or otherwise stop the release of a hazardous substance. Hazardous materials technicians shall have received at least 24 hours of training equal to the first responder operations level and in addition have competency in the following areas and the employer shall so certify:

(a) Know how to implement the employer's emergency response plan.

(b) Know the classification, identification and verification of known and unknown materials by using field survey instruments and equipment.

(c) Be able to function within an assigned role in the Incident Command System.

(d) Know how to select and use proper specialized chemical personal protective equipment provided to the hazardous materials technician.

(e) Understand hazard and risk assessment techniques.

(f) Be able to perform advance control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available with the unit.

(g) Understand and implement decontamination procedures.

(h) Understand termination procedures.

(i) Understand basic chemical and toxicological terminology and behavior.

(iv) **Hazardous materials specialist.** Hazardous materials specialists are individuals who respond with and provide support to hazardous materials technicians. Their duties parallel those of the hazardous materials technician, however, those duties require a more directed or specific knowledge of the various substances they may be called upon to contain. The hazardous materials specialist would also act as the site liaison with Federal, state, local and other government authorities in regards to site activities. Hazardous materials specialists shall have received at least 24 hours of training equal to the technician level and in addition have competency in the following areas and the employer shall so certify:

(a) Know how to implement the local emergency response plan.

(b) Understand classification, identification and verification of known and unknown materials by using advanced survey instruments and equipment.

(c) Know of the state emergency response plan.

(d) Be able to select and use roper specialized chemical personal protective equipment provided to the hazardous materials specialist.

(e) Understand in-depth hazard and risk techniques.

(f) Be able to perform specialized control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available.

(g) Be able to determine and implement decontamination procedures.

(h) Have the ability to develop a site safety and control plan.

(i) Understand chemical, radiological and toxicological terminology and behavior.

(v) **On scene incident commander.** Incident commanders, who will assume control of the incident scene beyond the first responder awareness level, shall receive at least 24 hours of training equal to the first responder operations level and in addition have competency in the following areas and the employer shall so certify:

(a) Know and be able to implement the employer's incident command system.

(b) Know how to implement the employer's emergency response plan.

(c) Know and understand the hazards and risks associated with employees working in chemical protective clothing.

(d) Know how to implement the local emergency response plan.

(e) Know of the state emergency response plan and of the Federal Regional Response Team.

(f) Know and understand the importance of decontamination procedures.

**(7) Trainers.** Trainers who teach any of the above training subjects shall have satisfactorily completed a training course for teaching the subjects they are expected to teach, such as the courses offered by the U.S. Fire Academy, or they shall have the training and/or academic credentials and instructional experience necessary to demonstrate competent instructional skills and a good command of the subject matter of the courses they are to teach.

**(8) Refresher training.**

(i) Those employees who are trained in accordance with paragraph (q)(6) of this section shall receive annual refresher training of sufficient content and duration to maintain their competencies, or shall demonstrate competency in those areas at least yearly.

(ii) A statement shall be made of the training or competency, and if a statement of competency is made, the employer shall keep a record of the methodology used to demonstrate competency.

**(9) Medical surveillance and consultation.**

(i) Members of an organized and designated HAZMAT team and hazardous materials specialists shall receive a baseline physical examination and be provided with medical surveillance as required in paragraph (f) of this section.

(ii) Any emergency response employees who exhibits signs or symptoms which may have resulted from exposure to hazardous substances during the course of an emergency incident, either immediately or subsequently, shall be provided with medical consultation as required in paragraph (f)(3)(ii) of this section.

**(10) Chemical protective clothing.** Chemical protective clothing and equipment to be used by organized and designated HAZMAT team members, or to be used by hazardous materials specialists, shall meet the requirements of paragraphs (g)(3) through (5) of this section.

**(11) Post-emergency response operations.** Upon completion of the emergency response, if it is determined that it is necessary to remove hazardous substances, health hazards, and materials contaminated with them (such as contaminated soil or other elements of the natural environment) from the site of the incident, the employer conducting the clean-up shall comply with one of the following:

(i) Meet all of the requirements of paragraphs (b) through (o) of this section; or

(ii) Where the clean-up is done on plant property using plant or workplace employees, such employees shall have completed the training requirements of the following: 29 CFR 1910.38(a); 1910.134; 1910.1200, and other appropriate safety and health training made necessary by the tasks that they are expected to be performed such as personal protective equipment and decontamination procedures. All equipment to be used in the performance of the clean-up work shall be in serviceable condition and shall have been inspected prior to use.

## APPENDICES TO 1910.120—HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE

**Note: The following appendices serve as non-mandatory guidelines to assist employees and employers in complying with the appropriate requirements of this section. However paragraph 1910.120(g) makes mandatory in certain circumstances the use of Level A and Level B PPE protection.**

### Appendix A—Personal Protective Equipment Test Methods

This appendix sets forth the nonmandatory examples of tests which may be used to evaluate compliance with § 1910.120 (g)(4)(ii) and (iii). Other tests and other challenge agents may be used to evaluate compliance.

A. Totally-encapsulating chemical protective suit pressure test.

1.0—Scope

1.1 This practice measures the ability of a gas tight totally-

encapsulating chemical protective suit material, seams, and closures to maintain a fixed positive pressure. The results of this practice allow the gas tight integrity of a totally-encapsulating chemical protective suit to be evaluated.

1.2 Resistance of the suit materials to permeation, penetration, and degradation by specific hazardous substances is not determined by this test method.

2.0—Definition of terms

2.1 "Totally-encapsulated chemical protective suit (TECP suit)" means a full body garment which is constructed of protective clothing materials; covers the wearer's torso, head, arms, legs and respirator; may cover the wearer's hands and feet with tightly attached gloves and boots; completely encloses the wearer and respirator by itself or in combination with the wearer's gloves and boots.

2.2 "Protective clothing material" means any material or combination of materials used in an item of clothing for the purpose of isolating parts of the body from direct contact with a potentially hazardous liquid or gaseous chemicals.

2.3 "Gas tight" means, for the purpose of this test method, the limited flow of a gas under pressure from the inside of a TECP suit to atmosphere at a prescribed pressure and time interval.

3.0—Summary of test method

3.1 The TECP suit is visually inspected and modified for the test. The test apparatus is attached to the suit to permit inflation to the pre-test suit expansion pressure for removal of suit wrinkles and creases. The pressure is lowered to the test pressure and monitored for three minutes. If the pressure drop is excessive, the TECP suit fails the test and is removed from service. The test is repeated after leak location and repair.

4.0—Required Supplies

4.1 Source of compressed air.

4.2 Test apparatus for suit testing, including a pressure measurement device with a sensitivity of at least ¼ inch water gauge.

4.3 Vent valve closure plugs or sealing tape.

4.4 Soapy water solution and soft brush.

4.5 Stop watch or appropriate timing device.

5.0—Safety Precautions

5.1 Care shall be taken to provide the correct pressure safety devices required for the source of compressed air used.

6.0—Test Procedure

6.1 Prior to each test, the tester shall perform a visual inspection of the suit. Check the suit for seam integrity by visually examining the seams and gently pulling on the seams. Ensure that all air supply lines, fittings, visor, zippers, and valves are secure and show no signs of deterioration.

6.1.1 Seal off the vent valves along with any other normal inlet or exhaust points (such as umbilical air line fittings or face piece opening) with tape or other appropriate means (caps, plugs, fixture, etc.). Care should be exercised in the sealing process not to damage any of the suit components.

6.1.2 Close all closure assemblies.

6.1.3 Prepare the suit for inflation by providing an improvised connection point on the suit for connecting an airline. Attach the pressure test apparatus to the suit to permit suit inflation from a compressed air source equipped with a pressure indicating regulator. The leak tightness of the pressure test apparatus should be tested before and after each test by closing off the end of the tubing attached to the suit and assuring a pressure of three inches water gauge for three minutes can be maintained. If a component is removed for the test, that component shall be replaced and a second test conducted with another component removed to permit a complete test of the ensemble.

6.1.4 The pre-test expansion pressure (A) and the suit test pressure (B) shall be supplied by the suit manufacturer, but in no case shall they be less than: (A) = three inches water gauge; and (B) = two inches water gauge. The ending suit pressure (C) shall be no less than 80 percent of the test pressure (B); i.e., the pressure drop shall not exceed 20 percent of the test pressure (B).

6.1.5 Inflate the suit until the pressure inside is equal to pressure (A), the pre-test expansion suit pressure. Allow at least one minute to fill out the wrinkles in the suit. Release sufficient air to reduce the suit pressure to pressure (B), the suit test pressure. Begin timing. At the end of three minutes, record the suit pressure as pressure (C), the ending suit pressure. The difference between the suit test pressure and the ending suit test pressure (B–C) shall be defined as the suit pressure drop.

6.1.6 If the suit pressure drop is more than 20 percent of the suit test pressure (B) during the three-minute test period, the suit fails the test and shall be removed from service.

7.0—Retest Procedure

7.1 If the suit fails the test check for leaks by inflating the suit to pressure (A) and brushing or wiping the entire suit (including seams, closures, lens gaskets, glove-to-sleeve joints, etc.) with a mild soap and water solution. Observe the suit for the formation of soap bubbles, which is an indication of a leak. Repair all identified leaks.

7.2 Retest the TECP suit as outlined in Test procedure 6.0.

8.0—Report

8.1 Each TECP suit tested by this practice shall have the following information recorded:

8.1.1 Unique identification number, identifying brand name, date of purchase, material of construction, and unique fit features, e.g., special breathing apparatus.

8.1.2 The actual values for test pressures (A), (B), and (C) shall be recorded along with the specific observation times. If the ending pressure (C) is less than 80 percent of the test pres-

sure (B), the suit shall be identified as failing the test. When possible, the specific leak location shall be identified in the test records. Retest pressure data shall be recorded as an additional test.

8.1.3 The source of the test apparatus used shall be identified and the sensitivity of the pressure gauge shall be recorded.

8.1.4 Records shall be kept for each pressure test even if repairs are being made at the test location.

Caution

Visually inspect all parts of the suit to be sure they are positioned correctly and secured tightly before putting the suit back into service. Special care should be taken to examine each exhaust valve to make sure it is not blocked.

Care should also be exercised to assure that the inside and outside of the suit is completely dry before it is put into storage.

B. Totally-encapsulating chemical protective suit qualitative leak test.

1.0—Scope

1.1 This practice semi-qualitatively tests gas tight totally-encapsulating chemical protective suit integrity by detecting inward leakage of ammonia vapor. Since no modifications are made to the suit to carry out this test, the results from this practice provide a realistic test for the integrity of the entire suit.

1.2 Resistance of the suit materials to permeation, penetration, and degradation is not determined by this test method. ASTM test methods are available to test suit materials for these characteristics and the tests are usually conducted by the manufacturers of the suits.

2.0—Definition of terms

2.1 "Totally-encapsulated chemical protective suit (TECP suit) means a full body garment which is constructed of protective clothing materials; covers the wearer's torso, head, arms, legs and respirator; may cover the wearer's hands and feet with tightly attached gloves and boots; completely encloses the wearer and respirator by itself or in combination with the wearer's gloves, and boots.

2.2 "Protective clothing material" means any material or combination of materials used in an item of clothing for the purpose of isolating parts of the body from direct contact with a potentially hazardous liquid or gaseous chemicals.

2.3 "Gas tight" means, for the purpose of this test method, the limited flow of a gas under pressure from the inside of a TECP suit to atmosphere at a prescribed pressure and time interval.

2.4 "Intrusion Coefficient" means a number expressing the level of protection provided by a gas tight totally-encapsulating chemical protective suit. The intrusion coefficient is calculated by dividing the test room challenge agent concentration by the concentration of challenge agent found inside the suit. The accuracy of the intrusion coefficient is dependent on the challenge agent monitoring methods. The larger the intrusion coefficient the greater the protection provided by the TECP suit.

3.0—Summary of recommended practice

3.1 The volume of concentrated aqueous ammonia solution (ammonia hydroxide $NH_4OH$) required to generate the test atmosphere is determined using the directions outlined in 6.1. The suit is donned by a person wearing the appropriate respiratory equipment (either a positive pressure self-contained breathing apparatus or a positive pressure supplied air respirator) and worn inside the enclosed test room. The concentrated aqueous ammonia solution is taken by the suited individual into the test room and poured into an open plastic pan. A two-minute evaporation period is observed before the test room concentration is measured, using a high range ammonia length of stain detector tube. When the ammonia vapor reaches a concentration of between 1000 and 1200 ppm, the suited individual starts a standardized exercise protocol to stress and flex the suit. After this protocol is completed, the test room concentration is measured again. The suited individual exits the test room and his stand-by person measures the ammonia concentration inside the suit using a low range ammonia length of stain detector tube or other more sensitive ammonia detector. A stand-by person is required to observe the test individual during the test procedure; aid the person in donning and doffing the TECP suit; and monitor the suit interior. The intrusion coefficient of the suit can be calculated by dividing the average test area concentration by the interior suit concentration. A colorimetric ammonia indicator strip of bromophenol blue or equivalent is placed on the inside of the suit face piece lens so that the suited individual is able to detect a color change and know if the suit has a significant leak. If a color change is observed the individual shall leave the test room immediately.

4.0—Required supplies

4.1 A supply of concentrated aqueous (58 percent ammonium hydroxide by weight).

4.2 A supply of bromophenol/blue indicating paper or equivalent, sensitive to 5-10 ppm ammonia or greater over a two-minute period of exposure. [pH 3.0 (yellow) to pH 4.6 (blue)]

4.3 A supply of high range (0.5-10 volume percent) and low range (5-700 ppm) detector tubes for ammonia and the corresponding sampling pump. More sensitive ammonia detectors can be substituted for the low range detector tubes to improve the sensitivity of this practice.

4.4 A shallow plastic pan (PVC) at least 12":14":1" and a half pint plastic container (PVC) with tightly closing lid.

4.5 A graduated cylinder or other volumetric measuring device of at least 50 milliliters in volume with an accuracy of at least ± 1 milliliters.

5.0—Safety precautions

5.1 Concentrated aqueous ammonium hydroxide, $NH_4OH$, is a corrosive volatile liquid requiring eye, skin, and respiratory protection. The person conducting the test shall review the MSDS for aqueous ammonia.

5.2 Since the established permissible exposure limit for ammonia is 50 ppm, only persons wearing a positive pressure self-contained breathing apparatus or a positive pressure supplied air respirator shall be in the chamber. Normally only the person wearing the totally-encapsulating suit will be inside the chamber. A stand-by person shall have a positive pressure self-contained breathing apparatus, or a positive pressure supplied air respirator available to enter the test area should the suited individual need assistance.

5.3 A method to monitor the suited individual must be used during this test. Visual contact is the simplest but other methods using communication devices are acceptable.

5.4 The test room shall be large enough to allow the exercise protocol to be carried out and then to be ventilated to allow for easy exhaust of the ammonia test atmosphere after the test(s) are completed.

5.5 Individuals shall be medically screened for the use of respiratory protection and checked for allergies to ammonia before participating in this test procedure.

6.0—Test procedure

6.1.1 Measure the test area to the nearest foot and calculate its volume in cubic feet. Multiply the test area volume by 0.2 milliliters of concentrated aqueous ammonia solution per cubic foot of test area volume to determine the approximate volume of concentrated aqueous ammonia required to generate 1000 ppm in the test area.

6.1.2 Measure this volume from the supply of concentrated aqueous ammonia and place it into a closed plastic container.

6.1.3 Place the container, several high range ammonia detector tubes, and the pump in the clean test pan and locate it near the test area entry door so that the suited individual has easy access to these supplies.

6.2.1 In a non-contaminated atmosphere, open a pre-sealed ammonia indicator strip and fasten one end of the strip to the inside of the suit face shield lens where it can be seen by the wearer. Moisten the indicator strip with distilled water. Care shall be taken not to contaminate the detector part of the indicator paper by touching it. A small piece of masking tape or equivalent should be used to attach the indicator strip to the interior of the suit face shield.

6.2.2 If problems are encountered with this method of attachment, the indicator strip can be attached to the outside of the respirator face piece lens being used during the test.

6.3 Don the respiratory protective device normally used with the suit, and then don the TECP suit to be tested. Check to be sure all openings which are intended to be sealed (zippers, gloves, etc.) are completely sealed. DO NOT, however, plug off any venting valves.

6.4 Step into the enclosed test room such as a closet, bathroom, or test booth, equipped with an exhaust fan. No air should be exhausted from the chamber during the test because this will dilute the ammonia challenge concentrations.

6.5 Open the container with the premeasured volume of concentrated aqueous ammonia within the enclosed test room, and pour the liquid into the empty plastic test pan. Wait two minutes to allow for adequate volatilization of the concentrated aqueous ammonia. A small mixing fan can be used near the evaporation pan to increase the evaporation rate of the ammonia solution.

6.6 After two minutes a determination of the ammonia concentration within the chamber should be made using the high range colorimetric detector tube. A concentration of 1000 ppm ammonia or greater shall be generated before the exercises are started.

6.7 To test the integrity of the suit the following four minute exercise protocol should be followed:

6.7.1 Raising the arms above the head with at least 15 raising motions completed in one minute.

6.7.2 Walking in place for one minute with at least 15 raising motions of each leg in a one-minute period.

6.7.3 Touching the toes with at least 10 complete motions of the arms from above the head to touching of the toes in a one-minute period.

6.7.4 Knee bends with at least 10 complete standing and squatting motions in a one-minute period.

6.8 If at any time during the test the colorimetric indicating paper should change colors, the test should be stopped and section 6.10 and 6.12 initiated (See §4.2).

6.9 After completion of the test exercise, the test area concentration should be measured again using the high range colorimetric detector tube.

6.10 Exit the test area.

6.11 The opening created by the suit zipper or other appropriate suit penetration should be used to determine the ammonia concentration in the suit with the low range length of stain detector tube or other ammonia monitor. The internal TECP suit air should be sampled far enough from the enclosed test area to prevent a false ammonia reading.

6.12 After completion of the measurement of the suit interior ammonia concentration the test is concluded and the suit is doffed and the respirator removed.

6.13 The ventilating fan for the test room should be turned on and allowed to run for enough time to remove the ammonia gas. The fan shall be vented to the outside of the building.

6.14 Any detectable ammonia in the suit interior (five ppm ammonia ($NH_3$) or more for the length of stain detector tube) indicates that the suit has failed the test. When other ammonia detectors are used a lower level of detection is possible, and it should be specified as the pass/fail criteria.

6.15 By following this test method, an intrusion coefficient of approximately 200 or more can be measured with the suit in a completely operational condition. If the intrusion coefficient is 200 or more, then the suit is suitable for emergency response and field use.

STANDARDS AND INTERPRETATIONS

7.0—Retest procedures

7.1 If the suit fails this test, check for leaks by following the pressure test in test A above.

7.2 Retest the TECP suit as outlined in the test procedure 6.0.

8.0—Report

8.1 Each gas tight totally-encapsulating chemical protective suit tested by this practice shall have the following information recorded.

8.1.1 Unique identification number, identifying brand name, date of purchase, material of construction, and unique suit features; e.g., special breathing apparatus.

8.1.2 General description of test room used for test.

8.1.3 Brand name and purchase date of ammonia detector strips and color change data.

8.1.4 Brand name, sampling range, and expiration date of the length of stain ammonia detector tubes. The brand name and model of the sampling pump should also be recorded. If another type of ammonia detector is used, it should be identified along with its minimum detection limit for ammonia.

8.1.5 Actual test results shall list the two test area concentrations, their average, the interior suit concentration, and the calculated intrusion coefficient. Retest data shall be recorded as an additional test.

8.2 The evaluation of the data shall be specified as "suit passed" or "suit failed," and the date of the test. Any detectable ammonia (five ppm or greater for the length of stain detector tube) in the suit interior indicates the suit has failed this test. When other ammonia detectors are used, a lower level of detection is possible and it should be specified as the pass fail criteria.

Caution

Visually inspect all parts of the suit to be sure they are positioned correctly and secured tightly before putting the suit back into service. Special care should be taken to examine each exhaust valve to make sure it is not blocked.

Care should also be exercised to assure that the inside and outside of the suit is completely dry before it is put into storage.

## Appendix B—General Description and Discussion of the Levels of Protection and Protective Gear

This appendix sets forth information about personal protective equipment (PPE) protection levels which may be used to assist employers in complying with the PPE requirements of this section.

As required by the standard, PPE must be selected which will protect employees from the specific hazards which they are likely to encounter during their work on-site.

Selection of the appropriate PPE is a complex process which should take into consideration a variety of factors. Key factors involved in this process are identification of the hazards, or suspected hazards; their routes of potential hazard to employees (inhalation, skin absorption, ingestion, and eye or skin contact); and the performance of the PPE *materials* (and seams) in providing a barrier to these hazards. The amount of protection provided by PPE is material-hazard specific. That is, protective equipment materials will protect well against some hazardous substances and poorly, or not at all, against others. In many instances, protective equipment materials cannot be found which will provide continuous protection from the particular hazardous substance. In these cases the breakthrough time of the protective material should exceed the work durations, or the exposure after breakthrough may not pose a hazardous level.

Other factors in this selection process to be considered are matching the PPE to the employee's work requirements and task-specific conditions. The durability of PPE materials, such as tear strength and seam strength, should be considered in relation to the employee's tasks. The effects of PPE in relation to heat stress and task duration are a factor in selecting and using PPE. In some cases layers of PPE may be necessary to provide sufficient protection, or to protect expensive PPE inner garments, suits or equipment.

The more that is known about the hazards at the site, the easier the job of PPE selection becomes. As more information about the hazards and conditions at the site becomes available, the site supervisor can make decisions to up-grade or down-grade the level of PPE protection to match the tasks at hand.

The following are guidelines which an employer can use to begin the selection of the appropriate PPE. As noted above, the site information may suggest the use of combinations of PPE selected from the different protection levels (i.e., A, B, C, or D) as being more suitable to the hazards of the work. It should be cautioned that the listing below does not fully address the performance of the specific PPE material in relation to the specific hazards at the job site, and that PPE selection, evaluation and re-selection is an ongoing process until sufficient information about the hazards and PPE performance is obtained.

Part A. Personal protective equipment is divided into four categories based on the degree of protection afforded. (See Part B of this appendix for further explanation of Levels A, B, C, and D hazards.)

I. Level A—To be selected when the greatest level of skin, respiratory, and eye protection is required.

The following constitute Level A equipment: it may be used as appropriate:

1. Positive pressure, full face-piece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA, approved by the National Institute for Occupational Safety and Health (NIOSH).

2. Totally-encapsulating chemical-protective suit.

3. Coveralls.[1]

4. Long underwear.[1]

5. Gloves, outer, chemical-resistant.

6. Gloves, inner, chemical-resistant.

7. Boots, chemical-resistant, steel toe and shank.

8. Hard hat (under suit).[1]

9. Disposable protective suit, gloves and boots (depending on suit construction, may be worn over totally-encapsulating suit).

II. Level B—The highest level of respiratory protection is necessary but a lesser level of skin protection is needed.

The following constitute Level B equipment; it may be used as appropriate.

1. Positive pressure, full-facepiece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA (NIOSH approved).

2. Hooded chemical-resistant clothing (overalls and long-sleeved jacket; coveralls; one or two-piece chemical-splash suit; disposable chemical-resistant overalls).

3. Coveralls.[1]

4. Gloves, outer, chemical-resistant.

5. Gloves, inner, chemical-resistant.

6. Boots, outer, chemical-resistant steel toe and shank.

7. Boot-covers, outer, chemical-resistant (disposable).[1]

8. Hard hat.[1]

9. [Reserved]

10. Face shield.[1]

III. Level C—The concentration(s) and type(s) of airborne substance(s) is known and the criteria for using air purifying respirators are met.

The following constitute Level C equipment; it may be used as appropriate.

1. Full-face or half-mask, air purifying respirators (NIOSH approved).

2. Hooded chemical-resistant clothing (overalls; two-piece chemical-splash suit; disposable chemical-resistant overalls).

3. Coveralls.[1]

4. Gloves, outer, chemical-resistant.

5. Gloves, inner, chemical-resistant.

6. Boots (outer), chemical-resistant steel toe and shank.[1]

7. Boot-covers, outer, chemical-resistant (disposable).[1]

8. Hard hat.[1]

9. Escape mask.[1]

10. Face shield.[1]

IV. Level D—A work uniform affording minimal protection, used for nuisance contamination only.

The following constitute Level D equipment; it may be used as appropriate:

1. Coveralls.

2. Gloves.[1]

3. Boots/shoes, chemical-resistant steel toe and shank.

4. Boots, outer, chemical-resistant (disposable).[1]

5. Safety glasses or chemical splash goggles*.

6. Hard hat.[1]

7. Escape mask.[1]

8. Face shield.[1]

Part B. The types of hazards for which levels A, B, C, and D protection are appropriate are described below:

I. Level A—Level A protection should be used when:

1. The hazardous substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either the measured (or potential for) high concentration of atmospheric vapors, gases, or particulates; or the site operations and work functions involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the skin;

2. Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible; or

3. Operations are being conducted in confined, poorly ventilated areas, and the absence of conditions requiring Level A have not yet been determined.

II. Level B—Level B protection should be used when:

1. The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection;

2. The atmosphere contains less than 19.5 percent oxygen; or

3. The presence of incompletely identified vapors or gases is indicated by a 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 skin.

[1]Optional, as applicable.

Note: This involves atmospheres with IDLH concentrations of specific substances that present severe inhalation hazards and that do not represent a severe skin hazard; or that do not meet the criteria for use of air-purifying respirators.

III. Level C—Level C protection should be used when:

1. The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin;

2. The types of air contaminants have been identified, concentrations measured, and an air-purifying respirator is available that can remove the contaminants; and

3. All criteria for the use of air-purifying respirators are met.

IV. Level D—Level D protection should be used when:

1. The atmosphere contains no known hazard; and

2. Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

Note: As stated before, combinations of personal protective equipment other than those described for Levels A, B, C, and D protection may be more appropriate and may be used to provide the proper level of protection.

As an aid in selecting suitable chemical protective clothing, it should be noted that the National Fire Protection Association is developing standards on chemical protective clothing. These standards are currently undergoing public review prior to adoption, including:

NFPA 1991—Standard on Vapor-Protective Suits for Hazardous Chemical Emergencies (EPA Level A Protective Clothing)

NFPA 1991—Standard on Liquid Splash-Protective Suits for Hazardous Chemical Emergencies (EPA Level B Protective Clothing.)

NFPA 1993—Standard on Liquid Splash-Protective Suits for Non-emergency, Non-flammable Hazardous Chemical Situations (EPA Level B Protective Clothing)

These standards would apply documentation and performance requirements to the manufacture of chemical protective suits. Chemical protective suits meeting these requirements would be labelled as compliant with the appropriate standard. When these standards are adopted by the National Fire Protection Association, it is recommended that chemical protective suits which meet these standards be used.

## Appendix C—Compliance Guidelines

1. **Occupational Safety and Health Program.** Each hazardous waste site clean-up effort will require an occupational safety and health program headed by the site coordinator or the employer's representative. The purpose of the program will be the protection of employees at the site and will be an extension of the employer's overall safety and health program. The program will need to be developed before work begins on the site and implemented as work proceeds as stated in paragraph (b). The program is to facilitate coordination and communication of safety and health issues among personnel responsible for the various activities which will take place at the site. It will provide the overall means for planning and implementing the needed safety and health training and job orientation of employees who will be working at the site. The program will provide the means for identifying and controlling worksite hazards and the means for monitoring program effectiveness. The program will need to cover the responsibilities and authority of the site coordinator or the employer's manager on the site for the safety and health of employees at the site, and the relationships with contractors or support services as to what each employer's safety and health responsibilities are for their employees on the site. Each contractor on the site needs to have its own safety and health program so structured that it will smoothly interface with the program of the site coordinator or principal contractor.

Also those employers involved with treating, storing or disposal of hazardous waste as covered in paragraph (p) must have implemented a safety and health program for their employees. This program is to include the hazard communication program required in paragraph (p)(1) and the training required in paragraphs (p)(7) and (p)(8) as parts of the employers comprehensive overall safety and health program. This program is to be in writing.

Each site or workplace safety and health program will need to include the following: (1) Policy statements of the line of authority and accountability for implementing the program, the objectives of the program and the role of the site safety and health supervisor or manager and staff; (2) means or methods for the development of procedures for identifying and controlling workplace hazards at the site; (3) means or methods for the development and communication to employees of the various plans, work rules, standard operating procedures and practices that pertain to individual employees and supervisors; (4) means for the training of supervisors and employees to develop the needed skills and knowledge to perform their work in a safe and healthful manner; (5) means to anticipate and prepare for emergency situations; and (6) means for obtaining information feedback to aid in evaluating the program and for improving the effectiveness of the program. The management and employees should be trying continually to improve the effectiveness of the program thereby enhancing the protection being afforded those working on the site.

Accidents on the site or workplace should be investigated to provide information on how such occurrences can be avoided in the future. When injuries or illnesses occur on the site or workplace, they will need to be investigated to determine what needs to be done to prevent this incident from occurring again. Such information will need to be used as feedback on the effectiveness of the program and the information turned into positive steps to prevent any reoccurrence. Receipt of employee suggestions or complaints relating to safety and health issues involved with site or workplace activities is also a feedback mechanism that can be used effectively to improve the program and may serve in part as an evaluative tool(s).

For the development and implementation of the program to be the most effective, professional safety and health personnel should be used. Certified Safety Professionals, Board Certified Industrial Hygienists or Registered Professional Safety Engineers are good examples of professional stature for safety and health managers who will administer the employer's program.

2. **Training.** The training programs for employees subject to the requirements of paragraph (e) of this standard should address: the safety and health hazards employees should expect

to find on hazardous waste clean-up sites; what control measures or techniques are effective for those hazards; what monitoring procedures are effective in characterizing exposure levels; what makes an effective employer's safety and health program; what a site safety and health plan should include; hands on training with personal protective equipment and clothing they may be expected to use; the contents of the OSHA standard relevant to the employee's duties and function; and, employee's responsibilities under OSHA and other regulations. Supervisors will need training in their responsibilities under the safety and health program and its subject areas such as the spill containment program, the personal protective equipment program, the medical surveillance program, the emergency response plan and other areas.

The training programs for employees subject to the requirements of paragraph (p) of this standard should address: the employers safety and health program elements impacting employees; the hazard communication program; the medical surveillance program; the hazards and the controls for such hazards that employees need to know for their job duties and functions. All require annual refresher training.

The training programs for employees covered by the requirements of paragraph (q) of this standard should address those competencies required for the various levels of response such as: the hazards associated with hazardous substances; hazard identification and awareness; notification of appropriate persons; the need for and use of personal protective equipment including respirators; the decontamination procedures to be used; preplanning activities for hazardous substance incidents including the emergency response plan; company standard operating procedures for hazardous substance emergency responses; the use of the incident command system and other subjects. Hands-on training should be stressed whenever possible. Critiques done after an incident which include an evaluation of what worked and what did not and how could the incident be better handled the next time may be counted as training time.

For hazardous materials specialists (usually members of hazardous materials teams), the training should address the care, use and/or testing of chemical protective clothing including totally encapsulating suits, the medical surveillance program, the standard operating procedures for the hazardous materials team including the use of plugging and patching equipment and other subject areas.

Officers and leaders who may be expected to be in charge at an incident should be fully knowledgeable of their company's incident command system. They should know where and how to obtain additional assistance and be familiar with the local district's emergency response plan and the state emergency response plan.

Specialist employees such as technical experts, medical experts or environmental experts that work with hazardous materials in their regular jobs, who may be sent to the incident scene by the shipper, manufacturer or governmental agency to advise and assist the person in charge of the incident should have training on an annual basis. Their training should include the care and use of personal protective equipment including respirators; knowledge of the incident command system and how they are to relate to it; and those areas needed to keep them current in their respective field as it relates to safety and health involving specific hazardous substances.

Those skilled support personnel, such as employees who work for public works departments or equipment operators who operate bulldozers, sand trucks, backhoes, etc., who may be called to the incident scene to provide emergency support assistance, should have at least a safety and health briefing before entering the area of potential or actual exposure. These skilled support personnel, who have not been a part of the emergency response plan and do not meet the training requirements, should be made aware of the hazards they face and should be provided all necessary protective clothing and equipment required for their tasks.

3. Decontamination. Decontamination procedures should be tailored to the specific hazards of the site, and may vary in complexity and number of steps, depending on the level of hazard and the employee's exposure to the hazard. Decontamination procedures and PPE decontamination methods will vary depending upon the specific substance, since one procedure or method may not work for all substances. Evaluation of decontamination methods and procedures should be performed, as necessary, to assure that employees are not exposed to hazards by re-using PPE. References in Appendix F may be used for guidance in establishing an effective decontamination program. In addition, the U.S. Coast Guard's Manual, "Policy Guidance for Response to Hazardous Chemical Releases," U.S. Department of Transportation, Washington, DC (COMDTINST M16465.30) is a good reference for establishing an effective decontamination program.

4. Emergency response plans. States, along with designated districts within the states, will be developing or have developed local emergency response plans. These state and district plans should be utilized in the emergency response plans called for in the standard. Each employer should assure that its emergency response plan is compatible with the local plan. The major reference being used to aid in developing the state and local district plans is the Hazardous Materials Emergency Planning Guide, NRT—1. The current Emergency Response Guidebook from the U.S. Department of Transportation, CMA's CHEMTREC and the Fire Service Emergency Management Handbook may also be used as resources.

Employers involved with treatment, storage, and disposal facilities for hazardous waste, which have the required contingency plan called for by their permit, would not need to duplicate the same planning elements. Those items of the emergency response plan that are properly addressed in the contingency plan may be substituted into the emergency response plan required in 1910.120 or otherwise kept together for employer and employee use.

5. Personal protective equipment programs. The purpose of personal protective clothing and equipment (PPE) is to shield or isolate individuals from the chemical, physical, and biologic hazards that may be encountered at a hazardous substance site.

As discussed in Appendix B, no single combination of protective equipment and clothing is capable of protecting against all hazards. Thus PPE should be used in conjunction with other protective methods and its effectiveness evaluated periodically.

The use of PPE can itself create significant worker hazards, such as heat stress, physical and psychological stress, and impaired vision, mobility, and communication. For any given situation, equipment and clothing should be selected that provide an adequate level of protection. However, overprotection, as well as under-protection, can be hazardous and should be avoided where possible.

Two basic objectives of any PPE program should be to protect the wearer from safety and health hazards, and to prevent

injury to the wearer from incorrect use and/or malfunction of the PPE. To accomplish these goals, a comprehensive PPE program should include hazard identification, medical monitoring, environmental surveillance, selection, use, maintenance, and decontamination of PPE and its associated training.

The written PPE program should include policy statements, procedures, and guidelines. Copies should be made available to all employees, and a reference copy should be made available at the worksite. Technical data on equipment, maintenance manuals, relevant regulations, and other essential information should also be collected and maintained.

6. Incident command system (ICS). Paragraph 1910.120(q)(3)(ii) requires the implementation of an ICS. The ICS is an organized approach to effectively control and manage operations at an emergency incident. The individual in charge of the ICS is the senior official responding to the incident. The ICS is not much different than the "command post" approach used for many years by the fire service. During large complex fires involving several companies and many pieces of apparatus, a command post would be established. This enabled one individual to be in charge of managing the incident, rather than having several officers from different companies making separate, and sometimes conflicting, decisions. The individual in charge of the command post would delegate responsibility for performing various tasks to subordinate officers. Additionally, all communications were routed through the command post to reduce the number of radio transmissions and eliminate confusion. However, strategy, tactics, and all decisions were made by one individual.

The ICS is a very similar system, except it is implemented for emergency response to all incidents, both large and small, that involve hazardous substances.

For a small incident, the individual in charge of the ICS may perform many tasks of the ICS. There may not be any, or little, delegation of tasks to subordinates. For example, in response to a small incident, the individual in charge of the ICS, in addition to normal command activities, may become the safety officer and may designate only one employee (with proper equipment) as a backup to provide assistance if needed. OSHA does recommend, however, that at least two employees be designated as back-up personnel since the assistance needed may include rescue.

To illustrate the operation of the ICS, the following scenario might develop during a small incident, such as an overturned tank truck with a small leak of flammable liquid.

The first responding senior officer would implement and take command of the ICS. That person would size-up the incident and determine if additional personnel and apparatus were necessary; would determine what actions to take to control the leak; and, determine the proper level of personal protective equipment. If additional assistance is not needed, the individual in charge of the ICS would implement actions to stop and control the leak using the fewest number of personnel that can effectively accomplish the tasks. The individual in charge of the ICS then would designate himself as the safety officer and two other employees as a back-up in case rescue may become necessary. In this scenario, decontamination procedures would not be necessary.

A large complex incident may require many employees and difficult, time-consuming efforts to control. In these situations, the individual in charge of the ICS will want to delegate different tasks to subordinates in order to maintain a span of control that will keep the number of subordinates, that are reporting, to a manageable level.

Delegation of task at large incidents may be by location, where the incident scene is divided into sectors, and subordinate officers coordinate activities within the sector that they have been assigned.

Delegation of tasks can also be by function. Some of the functions that the individual in charge of the ICS may want to delegate at a large incident are: medical services; evacuation; water supply; resources (equipment, apparatus); media relations; safety; and, site control (integrate activities with police for crowd and traffic control). Also for a large incident, the individual in charge of the ICS will designate several employees as back-up personnel; and a number of safety officers to monitor conditions and recommend safety precautions.

Therefore, no matter what size or complexity an incident may be, by implementing an ICS there will be *one individual in charge* who makes the decisions and gives directions; and, all actions, and communications are coordinated through one central point of command. Such a system should reduce confusion, improve safety, organize and coordinate actions, and should facilitate effective management of the incident.

7. Site Safety and Control Plans. The safety and security of response personnel and others in the area of an emergency response incident site should be of primary concern to the incident commander. The use of a site safety and control plan could greatly assist those in charge of assuring the safety and health of employees on the site.

A comprehensive site safety and control plan should include the following: summary analysis of hazards on the site and a risk analysis of those hazards; site map or sketch; site work zones (clean zone, transition or decontamination zone, work or hot zone); use of the buddy system; site communications; command post or command center; standard operating procedures and safe work practices; medical assistance and triage area; hazard monitoring plan (air contaminate monitoring, etc.); decontamination procedures and area; and other relevant areas. This plan should be a part of the employer's emergency response plan or an extension of it to the specific site.

8. Medical surveillance programs. Workers handling hazardous substances may be exposed to toxic chemicals, safety hazards, biologic hazards, and radiation. Therefore, a medical surveillance program is essential to assess and monitor workers' health and fitness for employment in hazardous waste operations and during the course of work; to provide emergency and other treatment as needed; and to keep accurate records for future reference.

The Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities developed by the National Institute for Occupational Safety and Health (NIOSH), the Occupational Safety and Health Administration (OSHA), the U.S. Coast Guard (USCG), and the Environmental Protection Agency (EPA); October 1985 provides an excellent example of the types of medical testing that should be done as part of a medical surveillance program.

## Appendix D—References

The following references may be consulted for further information on the subject of this standard:

1. OSHA Instruction DFO CPL 2.70—January 29, 1986. *Special Emphasis Program: Hazardous Waste Sites.*

2. OSHA Instruction DFO CPL 2-2.37A—January 29, 1986, *Technical Assistance and Guidelines for Superfund and Other Hazardous Waste Site Activities.*

3. OSHA Instruction DTS CPL 2.74—January 29, 1986, *Hazardous Waste Activity Form, OSHA 175.*

4. Hazardous Waste Inspections Reference Manual, U.S. Department of Labor, Occupational Safety and Health Administration, 1986.

5. Memorandum of Understanding Among the National Institute for Occupational Safety and Health, the Occupational Safety and Health Administration, the United States Coast Guard, and the United States Environmental Protection Agency, *Guidance for Worker Protection During Hazardous Waste Site Investigations and Clean-up and Hazardous Substance Emergencies.* December 18, 1980.

6. National Priorities List, 1st Edition, October 1984; U.S. Environmental Protection Agency, Revised periodically.

7. The Decontamination of Response Personnel, Field Standard Operating Procedures (F.S.O.P.) 7; U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Hazardous Response Support Division, December 1984.

8. Preparation of a Site Safety Plan, Field Standard Operating Procedures (F.S.O.P.) 9; U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Hazardous Response Support Division, April 1985.

9. Standard Operating Safety Guidelines; U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Hazardous Response Support Division, Environmental Response Team; November 1984.

10. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, National Institute for Occupational Safety and Health (NIOSH), Occupational Safety and Health Administration (OSHA), U.S. Coast Guard (USCG), and Environmental Protection Agency (EPA); October 1985.

11. Protecting Health and Safety at Hazardous Waste Sites; An Overview, U.S. Environmental Protection Agency, EPA/625/9—85/005; September 1985.

12. Hazardous Waste Sites and Hazardous Substance Emergencies, NIOSH Worker Bulletin, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health; December 1982.

13. Personal Protective Equipment for Hazardous Materials Incidents: A Selection Guide; U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health; October 1984.

14. Fire Service Emergency Management Handbook, International Association of Fire Chiefs Foundation, 101 East Holly Avenue, Unit 10B, Sterling, VA 22170, January 1985.

15. Emergency Response Guidebook, U.S. Department of Transportation, Washington, DC, 1987.

16. Report to the Congress on Hazardous Materials Training, Planning and Preparedness, Federal Emergency Management Agency, Washington, DC, July 1986.

17. Workbook for Fire Command, Alan V. Brunacini and J. David Beageron, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269, 1985.

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19. Incident Command System, Fire Protection Publications, Oklahoma State University, Stillwater, OK 74078, 1983.

20. Site Emergency Response Planning, Chemical Manufacturers Association, Washington, DC 20037, 1986.

21. Hazardous Materials Emergency Planning Guide, NRT-1, Environmental Protection Agency, Washington, DC, March 1987.

22. Community Teamwork: Working Together to Promote Hazardous Materials Transportation Safety. U.S. Department of Transportation, Washington, DC, May 1983.

23. Disaster Planning Guide for Business and Industry, Federal Emergency Management Agency, Publication No. FEMA 141, August 1987.

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