# AGCHEM SPILL RESPONSE

# PRE-TEST

Name: _____ Phone: _____

Company: _____

Address: _____

Instructions: You may use any resource available to you at your work location. This includes the manual which you received with this mailing. This also may include MSDS's, placards, DOT labels or any other information that deals with hazardous materials.

1. SDS stands for:

   a. Safety Defense Status
   b. Safety Data Sheet
   c. Studies of Dead Specimens
   d. Solid Disposal Survey

2. One of the most experienced people in the incident command structure should be the safety officer.

   True
   False

3. What are the "3" zones:

   a. Zone 1, Zone 2, Zone 3
   b. Hot, warm and very warm
   c. Hot, warm and cold
   d. Very cold, cold and lukewarm

4. Headaches, fatigue, dizziness, blurred vision, excessive sweating, nausea, vomiting, stomach cramps, diarrhea and salivation are signs and symptoms of anticholinesterase poisoning.

   True
   False

5. Key decisions regarding Initial Characterizations are:

   a. Imminent or potential risk to public health and to the environment
   b. Immediate need for protective actions to prevent or reduce the impact
   c. Protection of health and safety of response personnel
   d. All of the above

6. There are several reasons for consulting a MSDS. Which one is NOT found within the MSDS?

   a. Selection of personal protective equipment
   b. If substance is toxic
   c. Symptoms and signs of poisoning
   d. Application rate for cleaned up product

7. Personal protective equipment may be gloves, boots, chemical resistant suit, respirator or long cotton underwear.

   True
   False

8. When wearing an APR, concentration levels do not have to be considered.

   True
   False

9. Emergency and First Aid procedures or Special Treatment Procedures both deal with First Aid procedures.

   True
   False

10. An incident command system identifies who is in charge and a chain of command. Which one below DOES NOT fit this structure?

    a. Record keeping
    b. Security
    c. Safety
    d. Crosswalk guard

11. A decontamination area is located outside of the Hot Zone.

    True
    False

12. Level “D” suit-up is for splash protection.

    True
    False

13. On-site inspection and information gathering would also include material behavior such as foaming, vaporizing and corroding.

    True
    False

14. An SDS is also known internationally as an ICSC.

    True
    False

15. Level “C” protection is with the use of a self-contained breathing apparatus.

    True
    False

16. To safely handle an incident we must minimize the chance for exposure.

    True
    False

17. Routes of exposure may be through:

    - Inhalation
    - Skin contact
    - Skin absorption
    - Eye contact
    - Ingestion

    True
    False

18. A response plan can be of great importance as well as a written incident command system.

    True
    False

19. CRC stands for:

    a. Contamination Reduction Corridor
    b. Cleanup Response Center
    c. There is no such thing
    d. None of the above

20. Standing up or up-righting a leaking container means controlling a release.
    Pg 5-1
    True
    False

21. What item below is NOT recommended for diking material?

    a. Tree bark
    b. Bagged dog food
    c. Sand
    d. Gravel
    e. Kitty litter

22. The standardized style for the international safety data sheet contains 16 sections.

    True
    False

23. When wearing an APR, a person may work below 19.5% oxygen concentration.

    True
    False

24. Signal words may include: Danger, Watch Out, Attention, Warning, and Caution.

    True
    False

25. Steel wool is a material used for sealing a crack in a leaking container.

    True
    False

26. Mitigation means to control a release.

True
False

27. When selecting personal protective equipment, which item is not a requirement?

a. Penetration
b. Tailored fit
c. Degradation
d. Permeation

28. Doffing personal protective equipment must be done in a step-by-step order.

True
False

29. Vermiculite is non-reactive to most materials.

True
False

30. Without an emergency response plan, an ad-hoc functional organization must be created for that specific incident with those who are available.

True
False

# PESTICIDE MATERIALS

## PESTICIDE EMERGENCY RESPONSE MANUAL

**Far West Agribusiness Association**

# AgCHEM SPILL RESPONSE

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**Course Objectives**

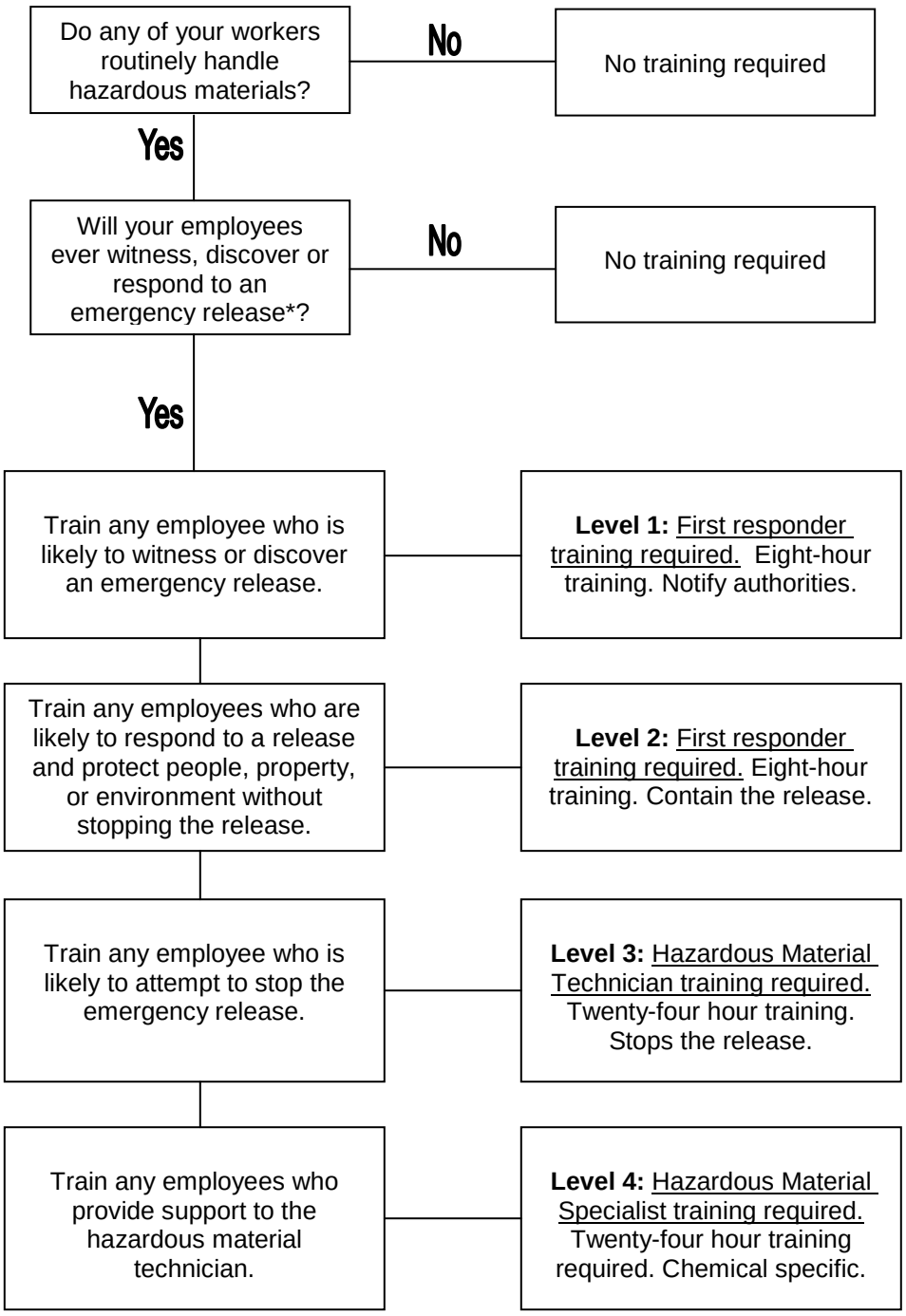
The objective of this training will be to provide an additional 16 hours of training to those who have 8 hours hazardous materials training. A total of 24 hours of hazardous materials training is required by OSHA to achieve the designation of Basic Technician Level Training specific to fertilizer and pesticides.

**Topics Covered**

- Using Chemtrec
- Environmental effects:
  Minimizing pollution, containment, etc., in a pesticide incident
- Medical aid for pesticide poisoning
- Rescue and decontamination of victims
- Transportation
- Decontamination of yourself
- Clean up of site, methods available
- Suggestions for proper disposal or use of spilled product
- Reporting of spills of your products and other Legal issues
- Fire involving pesticides

*"All things are poisonous, for there is nothing without poisonous qualities. It is only the dose which makes a thing a poison." ---*
*Paracelsus (1493 – 1541)*

## AgCHEM TRAINING REQUIREMENTS




* An emergency release is defined as a response effort by employees from outside of the immediate release area or by other designated responders (i.e. local fire departments) to an occurrence which results, or is likely to result in an uncontrolled release which may cause high levels of exposure to toxic substances, or which poses danger to employees requiring immediate attention.

# HAZARD RECOGNITION AND RISK EVALUATION
# Chapter 01

## INCIDENT CHARACTERIZATION

To accomplish the primary objective in responding to hazardous materials incidents is to prevent or reduce detrimental effects to public health or to the environment. To accomplish this it is necessary to:

A. Identify the substance involved.

B. Evaluate its behavior when released and its effects on public health and the environment.

C. Initiate actions to prevent or modify its effects.

From the start to finish of an incident, a high-priority activity is in obtaining the necessary information to evaluate its' impact. This process of identifying the substance involved, evaluating actual or potential impact on public health, and the environment, is called Incident Characterization.

In those incidents where the substance involved is known or easily identified, the pathways of dispersion are clearly defined, and the effect or potential impact is demonstrated, characterization is relatively straightforward. For example, the effects of a large discharge of **Vinyl Chloride** on fish in a small stream are relatively easy to evaluate. An incident such as an abandoned waste site containing 60,000 fifty-five gallon drums is more complex since there is generally not enough initial information to determine the hazards and to evaluate their impact.

Evaluating a hazardous substance incident is generally a two-phase process: an initial characterization, and a more comprehensive characterization.

## INITIAL CHARACTERIZATION

The initial characterization is based on information that is readily available or can be obtained fairly rapidly to determine what hazards exist and if immediate protective measures are necessary. During this initial phase, a number of key decisions must be made regarding:

A. Imminent or potential risk to public health and to the environment.

B. Immediate need for protective actions to prevent or reduce the impact.

C. Protection of health and safety of response personnel.

After immediate control measures have been taken, other activities to restore the area to environmentally acceptable conditions may begin. If there is no emergency, more time is available to evaluate hazards, to design plans for cleanup, and to establish safety requirements for response personnel. Information for characterizing the hazards can be obtained from intelligence (records, placards, eye-witnesses, etc.,) direct-reading instruments, and sampling. Depending on the nature of the incident and the amount of time available, various combinations of these information-gathering processes are used.

The following outline describes an approach to collecting data needed to evaluate the impact on a hazardous materials incident. Not every incident requires obtaining all items, nor using the approach recommended. The list provides a relatively detailed (though not all-inclusive) guide, which could be adapted to meet site-specific conditions.

## A. Data Gathering and Preliminary Assessment

Upon notification or discovery of an incident, obtain the following:

1. Brief description
2. Exact location
3. Date and time of occurrence
4. Hazardous materials involved and their physical/chemical properties
5. Present status of incident
6. Potential pathways of dispersion
7. Habitation-population at risk
8. Environmentally sensitive areas - endangered species, delicate ecosystems
9. Economically sensitive areas - industrial, agricultural
10. Accessibility by air and roads
11. Waterways
12. Current weather and forecast
13. Terrain-include topographic map
14. Geology and hydrology-include appropriate maps
15. Aerial photographs
16. Communications
17. Any other related background information

## B. Preliminary Inspection

Off-Site Reconnaissance

1. At responses in which the hazards are likely unknown or there is no need to go on-site immediately, make visual observations and monitor atmospheric hazards near the site. Also, collect various types of off-site samples that may indicate on-site conditions or migration from the incident.

2. In addition to collecting information that is not available from the preliminary assessment or needed to verify or supplement the preliminary assessment, off-site reconnaissance would include:

   a. General layout and map of the site

   b. Placards, labels, and/or markings on containers or transportation vehicles.

   c. Configuration of containers, tank cars, and trailers.

   d. Types and numbers of containers, buildings, and impoundments

   e. Leachate or run-off

   f. Biological indicators-dead vegetation, animals, insects, and fish

   g. Unusual odors or conditions

   h. Visual observations of vapors, clouds, or suspicious substances

On-Site survey

1. A more thorough evaluation of hazards generally necessitates personnel entering the defined site. Prior to going on-site, develop an entry plan addressing what will be initially accomplished and prescribing the procedures to protect the health and safety of response personnel.

2. Establish zones to control access to targeted areas:

   Hot Zone – The area most immediately affected by the chemical release. Contamination is presumed to have occurred here. This zone may be altered or reassessed throughout the incident.

   Warm Zone – The area where access control points connecting the Exclusion and Safe Zones are established. Contamination is restricted to corridor areas. Decon is set up here in the contamination reduction corridor.

   Cold Zone – The area where support is conducted for Hot Zone operations. There is no contamination in this area. The Command post is established here.

3. On-site inspection and information gathering would include:

   a. Types of containers, impoundments, or other storage systems:
      1) Numbers, types, and quantities of materials
      2) Condition of storage systems (such as state of repair or deterioration)

   b. Physical condition of material:
      1) Solids, liquids, gases
      2) Color
      3) Behavior: foaming, vaporizing, corroding

   c. Leaks or discharges from containers, tanks, ponds, vehicles

   d. Potential pathways of dispersion
      1) Air
      2) Surface water
      3) Land surface
      4) Biological routes

   e. Labels, markings, identification tags, or other indicators of material

   f. Container configuration, shape of tank cars or trailers

**COMPREHENSIVE CHARACTERIZATION**

The second phase, comprehensive characterization (which may or may not be needed in all responses), is a more methodical investigation to enhance, refine, and enlarge the information base obtained during the preliminary inspection. This phase provides more complete information for characterizing the hazards associated with an incident. As a continuously operating program, the second phase also reflects environmental changes resulting from response activities.

Available information and information obtained through initial site entries may be sufficient to thoroughly identify and assess the human and environmental effects of an incident. If not, an environmental surveillance program needs to be implemented. Much of the same type of information as collected during the preliminary inspection is needed. However, it may be much more extensive. Instead of one or two groundwater samples being collected, an extensive groundwater survey may be needed over a long period of time. Results from the preliminary inspection provide a screening mechanism for a more complete environmental surveillance program to determine the extent of contamination. Also, since mitigation and remedial measures may cause changes in the original conditions, a continual surveillance program must be maintained to identify any changes.

# AgCHEM SPILL RESPONSE

## SUMMARY

Evaluating the hazards associated with an incident involves degrees of complexity. The release of a single, known chemical compound may represent a relatively simple problem. It becomes progressively more difficult to determine harmful effects as the number of compounds increase. Evaluation of the imminent or potential hazards associated with an abandoned waste site, storage tanks, or lagoons holding vast amounts of known or unknown chemicals substances, is far more complex than a single release of an identifiable substance. The major responsibility of response personnel is the protection of public health and the environment. The effective accomplishment of this goal is dependent upon a thorough characterization of the chemical compounds involved, their dispersion pathways, and concentrations in the environment, their toxic effects. A base of information is developed over the lifetime of the incident to assess the harmful effects and ensure that effective actions are taken to mitigate the release.

## CHEMICAL CHARACTERISTICS AND SAFETY DATA SHEETS

- **Use**
- **Interpretation**
- **Solvent Example Review**
- **Terminology**
- **Solvent Worksheet**

## DEFINITION

A Material Safety Data Sheet (SDS) contains information necessary for recognizing the hazards of a particular material, the safe conditions for handling it, and emergency procedures for containing or neutralizing it. The Federal Occupational Safety and Health Administration regulations require that there be a SDS for each hazardous chemical produced or imported.

The purpose of the Hazard Communication Standard is to ensure that the hazards of all chemicals manufactured or imported are evaluated, and furthermore that information concerning the hazards is transmitted to employees who are exposed to them. This is to be done by labeling and other forms of warning, by training programs, and by Safety Data Sheets. The standard requires employers to inform employees of the requirements of the standard, to identify any operations in their work area where hazardous chemicals are present, and to give the location of written information resources, including required plans for compliance, lists of hazardous chemicals used, and the required Safety Data Sheets. The Safety Data Sheets must provide, at minimum, the following information:

* Identification
* Physical and chemical characteristics
* Physical hazards
* Health hazards
* Primary routes of entry to the body
* Permissible exposure limits
* Indications of carcinogenicity
* Precautions for safe handling, and protective measures
* Cleanup measures for spills and leaks
* Control measures
* Emergency first aid procedures
* Identifying data on date of preparation, and the name, address, and telephone number of manufacturer, importer, or employer preparing the SDS

**Identification:**

The SDS must give the chemical and common identity of the trade or product name used on the container label. If the substance is a mixture, any hazardous components making up more than 1 percent of the mixture must be listed by their chemical and common names. If the mixture itself has a name, that must also be listed. Carcinogens must be listed if they make up more than 0.1 percent of the mixture. Components that have been found to be hazardous as a result of tests conducted must also be listed even if they are present in concentrations below 1 percent.

The biggest problem with agricultural chemicals and compounds is identifying their active ingredients. Manufacturers are allowed to withhold the identity of a chemical substance if it is a trade secret. Their products are often given names that are not related to their specific chemical properties. The standard specifies emergency provisions under which health professionals and others can obtain the identity of the substance, if this information is needed for emergency or first aid treatment.

**Physical and Chemical Characteristics**

Materials can be characterized by the measurement of various properties of their states (gas, liquid, or solid) or of a change from one state to another. With some of the pesticides, the active ingredient is often not the most hazardous substance of the compound. Inert ingredients may violently react when accidentally combined with other chemicals than when used by themselves. Other inert ingredients are flammable or more toxic than the active ingredient. Be sure to study the entire composition of the product.

Some of the data listed on the SDS under physical and chemical characteristics simply describes the appearance of the material. Many substances have characteristic odors, which are often detectable at very low concentrations. This characteristic acts as an early warning for leaks. Within the limits of safety, it is a good idea for workers to be familiar with the characteristic odors of the chemicals they work with.

Physical data may provide an indication of hazard. Such data includes the melting point, the boiling point (a low boiling point indicates a volatile substance), evaporation rate, vapor pressure, and percent volatile by volume (indicating how much of a mixture can evaporate).

**Physical Hazards**

Some materials have the potential for causing physical damage, usually by corrosive action, explosion or fire. Data that would be valuable for understanding these hazards include:

**Flash Point** – The temperature at which a liquid forms a combustible mixture with the surrounding air.

**Flammable Limits** – Given in percent by volume in air. It indicates the concentration in air at which the mixture will ignite with an outside ignition source.

**Auto-ignition Temperature** – The temperature at which a material spontaneously bursts into flame. It is the lowest temperature at which the material will ignite without an external source of ignition.

**Health Hazards**

The OSHA Hazard Communication Standard defines seven specific categories of health hazards that must be taken in to account in evaluation of workplace hazards. These are:

- Carcinogens
- Corrosives
- Highly toxic materials
- Irritants
- Sensitizers
- Toxic materials
- Target organ effects

For the purposes of this standard, these are defined in terms of the results of biological tests and observations.

**Primary Routes of Entry to the Body**

Routes of exposure of toxic materials include:

- Inhalation
- Skin contact
- Skin absorption
- Eye contact
- Ingestion

Information on the point of attack will help in taking preventative measures or in selecting the proper protective equipment.

**Permissible Exposure Limits**

Maximum permissible concentrations of exposure usually involve both the concentration of the chemical and the duration of the exposure. They may be expressed as time weighted average concentration over a work shift and perhaps additionally as an allowable peak value during any one period.

**Indications of Carcinogenicity**

The MSDS must note any evidence that a substance can cause cancer. The standard requires a statement if the substance is listed in the **National Toxicology Program Annual Report on Carcinogens,** or if OSHA lists it as a potential carcinogen in the International Agency for Research on Cancer Monographs.

**Precautions for Safe Handling and Protective Measures**

Information includes the specification of safe storage conditions and a warning of the possibility of reaction with other substances. Different materials will react under different conditions, and the information given on the MSDS should indicate conditions to avoid.

**Cleanup Procedures for Spills and Leaks**

The MSDS lists steps to be taken if the material is released or spilled. The information applies to personal safety and protection, as well as containment and cleanup measures to prevent the contamination of the environment.

**Control Measures**

The SDS lists any generally applicable control measures known to the chemical manufacturer, including appropriate engineering controls. This would include safe operating limits for concentration, temperature, and pressure. Proper work practices and required personal protective equipment are also to be listed.

**Emergency and First Aid Procedures**

Clear instructions are given for medical treatment, including specific antidotes, routes of entry, and care of the victim. Individual chemicals can have highly individualized effects causing particular physiological effects, leading to delayed symptoms, and requiring specific antidotes or treatment. Therefore, there are notes for a physician regarding special treatment procedures.

**Identifying Data**

The SDS lists the data of its preparation or the date of the last change, the name, address, and telephone number of the manufacturer so that additional information on the hazardous chemical and appropriate emergency procedures can be obtained.

**Other Provisions of the OSHA Standard**

The OSHA standard requires the use of labels on containers of hazardous materials. The labels are to have information on the identity of the hazardous chemical, appropriate hazards warnings, and the name and address of the manufacturer.

The OSHA standard requires training courses to instruct employees in the requirements of the plant safety program, the use of protective equipment, work practices, and the meaning of SDS's and labels.

Workers are to be trained about the hazards of chemicals present in their work area at the time of their initial assignment and whenever a new hazard is introduced into their work area. Information must be provided for each hazardous chemical. It must be readily accessible during each work shift to employees when they are in their work area.

The standard also requires that the SDS be updated. Anyone purchasing a chemical for use should receive and read the SDS supplied by the manufacturer.

SDS sheets can be in any format; the order in which specific information is listed can vary from one manufacturer to another.

**Safety Data Sheets**

Chemicals pose a wide range of hazards, from mild irritation to possible death. OSHA's Hazard Communication Standard is designed to ensure that workers and employers have information about these hazards and can establish appropriate protective measures. One important source of this information is the Safety Data Sheet (SDS).

The SDS is your primary tool for finding information about the chemicals you work with. They can be in any format, but OSHA has established certain requirements for SDSs. First of all, they need to be in English.

Secondly, all SDSs must be readily accessible during each work shift. If you or your co-workers must travel between work locations, SDSs may be kept at a central location, but they still need to be accessible.

Chemical manufacturers and importers are required to obtain or develop a material safety data sheet for each hazardous chemical they produce or import. Distributors are responsible for ensuring that their customers are provided a copy of these MSDSs. Employers must receive and retain an MSDS for each hazardous chemical that they use.

While SDSs need not be physically attached to a shipment, they must accompany or precede the shipment. If they do not, your employer must obtain one from the chemical manufacturer, importer, or distributor as soon as possible. The same is true if an SDS arrives that is incomplete or unclear.

You need to read a chemical's SDS before using the chemical to find out what safety precautions are needed A certain chemical may not be compatible with other chemicals you are using. You may need to wear a respirator to protect yourself from the chemical's effects. You may need to be careful about the ambient temperature the chemical is used in. The information on an SDS will help you determine what safety measures you will need and could save valuable time in the event of an accident.

There are several reasons you may need to consult an SDS:

- To determine if symptoms you are experiencing can be attributed to chemicals you work with.
- To ensure that the personal protective equipment you are using is appropriate for the chemicals you are using.
- To find out if substances you are working with are toxic.
- To verify the information on the label of a chemical that you are using.

In the case of an emergency where someone may have been exposed to a hazardous chemical, you may also need to consult the associated SDS to obtain information on how to treat the victim.

Being aware of the information provided on an SDS can mean the difference between an accident and a tragedy. For your safety and those you work with, learn the hazards of the chemicals you work with and the precautions related to them.

OSHA SDS Initiative and Sample SDSs

OSHA has formed an Alliance with the Society for Chemical Hazard Communication (SCHC), a professional society that focuses on hazard communication issues. OSHA and SCHC will work together to produce several products for this initiative, including a course for small businesses on preparation of SDSs; development of a training program for OSHA compliance staff on review of SDS information; and development of a checklist to use to review SDSs for the inclusion of certain information will be made available on OSHA's website.

Under this program, the Agency will choose a certain number of chemicals, and following the requirements in the HCS, identify some critical elements (phrases, words, etc.) that should appear on an accurate SDS. Compliance officers would use this information as they encounter these chemicals at worksites.

Where MSDSs are found that do not contain these critical elements, OSHA will notify the manufacturer in writing of the deficiencies or inaccuracies. Manufacturers will be required to correct and update their SDS. They will then have to respond to OSHA and inform the Agency of the steps taken to correct and update their data sheet. Those manufacturers that fail to respond or do not update their SDS can potentially be cited under the HCS.

In addition, compliance staff and the public are being made aware of the availability of International Chemical Safety Cards on OSHA's web page. These cards are similar to SDSs in terms of the information provided. They are internationally developed and peer reviewed, cover over 1300 substances, and are available in 14 languages. They are a good screening tool to be used when reviewing SDSs on the substances they cover, and are going to be modified to be consistent with the GHS classification criteria and SDS format.

**MSDSs and the Globally Harmonized System**

Workplace safety groups around the globe are trying to develop a common set of workplace hazard communication guidelines that all countries can use. When these guidelines have been finished they will affect hazard communication labeling and communication.

**Chemical Safety Information**

One part of this globally harmonized system is the publishing of chemical safety information. These chemical safety data sheets, which we know as SDSs, are published under several names, such as:

- International chemical safety card, ICSC.
- Chemical safety card
- Chemical info-sheet
- Product safety data sheet
- Health and safety data
- Safety data sheet

**The GHS SDS**

The standardized style for the international safety data sheet, which has been adopted by the International Labor Organization (ILO), contains sixteen sections. The safety data sheet contains the following sections:

**1.** Identification:
- Name of the substance or preparation
- Name, address and telephone number of the company/supplier/undertaking

**2.** Composition and information on ingredients
**3.** Hazards identification
**4.** First-aid measures
**5.** Fire-fighting measures
**6.** Spillage, accidental release measures
**7.** Handling and storage
**8.** Exposure controls and personal protection
**9.** Physical and chemical properties
**10.** Stability and reactivity
**11.** Toxicological information
**12.** Ecological information
**13.** Disposal considerations
**14.** Transport information
**15.** National regulations and references
**16.** Other information

**HEALTH HAZARDS AND TOXICOLOGY**

**1. Definition**

Toxicology is the study of the nature and actions of poisons.

**2. Dose-Response Relationships and Curves**

The toxic potency of a chemical is defined by the relationship between the dose and the response produced in a biological system. **All substances are potentially toxic**.

**3. Types of Exposure**

**Acute**

1. One time high level
2. Symptoms and results are usually immediate, but can be delayed.
3. May be reversible or irreversible.
   Immediate – Skin burns, Class A poisons
   Delayed – Phenol, inhaled acid vapors

**Chronic**

1. Usually a low level exposure over a period of time.
2. May be reversible or irreversible
   Carcinogens, heavy metals

**4. Symptoms**

May be obvious or delayed. Irritation, headache, nausea, narcosis, weakness diarrhea, skin defatting.

**5. Routes of Exposure**

1. Inhalation - Most common and efficient route, causes respiratory tract injury and can lead to wider body damage. Soluble products like anhydrous ammonia attack the mucous membranes of the mouth, nose, and throat first. Once in the lungs, they combine with trapped moisture to generate heat from the chemical reaction dissolving and scarring the alveoli. Less soluble products like hydrogen phosphide fumigants, release phosphine gas, and cause irreparable damage to lung tissue.
2. Skin Absorption - Some chemicals move rapidly through skin tissue, much like DMSO causing skin irritation and systemic effects. Local irritation or dermatitis is the most common industrial injury (approximately 50%).
3. Ingestion - Many products such as those containing paraquat as an active ingredient can kill with just a taste. Food and drinks may become contaminated and ingested after cleanup operations. Poor hygiene habits include improper washing of hands and skin areas or eating in an area of contamination.

**6. Chemical Classifications**

1. Irritants: Causes inflammation of skin or mucous membranes through contact
   ammonia, chlorine, agricultural fungicides.
2. Sensitizers: Cause mild to severe reactions and the formation of antibodies upon first exposure. May cause severe allergic reactions or death upon subsequent exposures.
3. Asphyxiants: Deprive the tissues of oxygen
   CO2, Carbon Monoxide, Cyanides.
4. Poisons: Cause systemic damage to brain, kidneys, or liver
   Hydrogen sulfide, lead, mercury, pesticides, skin absorbable poisons.
5. Carcinogens: Substances capable of causing malignant body growth
   Arsenic, asbestos, benzene, PCB's, chlorinated pesticides, and solvents.
6. Mutagens: Substances capable of causing genetic changes in cells
   Urethanes
7. Teratogens: Substances capable of causing fetal damage
   Lead, mercury, copper, organophosphates, thalidomide (once used to prevent morning sickness in pregnancies)

**7. Fate of Chemicals in Biological Systems**

1. Biological Barriers - Mucous membranes and skin
2. Bioconcentration - Certain chemicals accumulate in body tissues, organs, and fats.
3. Metabolism - The body changes many chemicals to less harmful forms in the kidneys and liver. Unless acutely overloaded.
4. Excretion - The body is capable of "discarding" chemical substances through time via feces, urine, exhaled air, sweat, hair, nails, and milk.

**8. Factors Affecting Toxicity and Exposure Potential**

Is it possible for one person to be irritated, harmed, or seriously injured from exposure to a chemical in the midst of coworkers who seem fine?

Statement: What about the employee who tells his new line associate, "Don't worry about this stuff, I've been working with it for years and I'm still okay."

Question: Are you really sure? Besides, how do you know that my body is just like yours?

Point: Many different factors affect the individual impact of chemicals on a human being.

Consider these factors when assigning employees to work in chemical area:

Age
State of health
Allergenic history
Likelihood of exposure
Routes and rates of entry

Remember to consider medical checks for employees who work with NIOSH regulated substances and those who report symptoms of effect through acute or chronic exposure.

# INCIDENT COMMAND SYSTEM
# Chapter 02

## Introduction

The number of personnel needed to respond to an incident involving pesticides can vary greatly. Regardless if few or many responders are involved they must be organized. Without a coordinated, organized effort the primary reason for responding, to protect the public's health, the environment and property, may be ineffective.

Every pesticide or fertilizer spill is unique. The materials involved, their effect, as well as the operations (activities) required to prevent or reduce the effect of their release, are incident specific. Common, however, to all incidents is the need for planning, organizing, locating resources, (personnel, equipment, and with illegal pesticide dumps, funds), in order to implement response operations.

## Contingency Plans for Emergency Response

When an incident involving pesticides or any other kind of hazardous material occurs, people in the affected area will attempt to control or alleviate the situation. Some sort of organization, comprised of all who are available, will naturally evolve. Its capability however, to efficiently manage the situation may be severely restricted. Experienced personnel, equipment and other necessary resources may not be readily available, causing the prompt actions needed to abate the situation to be delayed.

A more effective response to any kind of pesticide spill, or other hazardous materials incidents, ensues when a emergency plan exists. In general, emergency plans anticipate the myriad of problems faced by responders and through the planning process develop, in advance, solutions. A functional response organization is developed and resources are identified. Notification systems are determined and arrangements made to obtain technical as well as other kinds of assistance.

When the plan is activated, the organization can rapidly begin to function. Control activities are initiated with less confusion and fewer delays than are encountered in implementing operations in a "no-plan" response. A pre-existing plan also reduces the risk to both the responders and the public by establishing, in advance, procedures for protecting their health and safety.

An emergency plan can lessen many of the problems encountered in a response to any spill or release of product. However, even a good, tested plan cannot anticipate and address all the circumstances created by a release of certain chemicals. Modifications may be needed to accommodate unforeseen events. A well-written plan acknowledges that incident specific adaptations are necessary and is written to provide flexibility.

For hazardous materials emergency plans to be effective, they must be:

- Well-written
- Continuously reviewed and modified
- Contents are known by all involved
- Flexible
- Frequently tested
- Current

## Organizing the Response Effort

The number of people responding to an incident may range from a few to hundreds, and represent a variety of sources from government as well as private industry. Trained responders from local jurisdictions readily manage some incidents. Others may require additional responders from state and federal agencies and from private industries. These groups, each with diverse functions and responsibilities, must be organized into a cohesive unit capable of conducting the required remedial activities.

Hazardous materials response plans exist at each level of government local, state, and federal. Each plan defines how that level of government will respond, establishes the response organization, and provides operational procedures. The federal response plan recognizes the role of local and state responders in a federal response effort. It contains provisions for incorporating local and state authorities into its response organization as well as providing a mechanism for coordinating response efforts for all levels of government. Likewise, state plans contain their role, responsibilities, and relationships with local government response activities.

In general, federal, state and local response plans vary considerably in detail and scope. Local plans are usually more specific; state and national plans are not as definitive. Typically however, whichever plan is in effect, the organization delineated is adapted and modified to meet the needs of the incident.

To function efficiently, the organization, which is established, must:

- Provide a leader
- Establish authority
- Develop policy and procedures
- Determine objectives
- Assign responsibilities
- Manage resources
- Plan and direct operations
- Establish internal communications
- Establish communications with outside organizations

Without an emergency response plan, an ad hoc functional organization must be created, for that specific incident, with those who are available.

**Table of Organization**

In any organization, involving more than a few responders, it is necessary to define its structure. This structure the Table of Organization defines is the relationship between the various components (divisions, branches, or sections) of the organization. It delineates a chain of command and establishes internal communication channels.

Organization tables are complemented by functional statements, which describe the authority, responsibilities, and duties of the organization's components. To a large degree, the form and complexity of the organization chart and the functional statements depend on the magnitude of the incident, the operations needed, and the number of people or agencies involved. The key requirements of an organization chart are:

- Delineating a chain-of-command
- Assigning responsibilities and functions
- Specifying personnel requirements
- Establishing internal communications

**Key Personnel and Their Functions**

The response team is an organized group of people each with assigned tasks and responsibilities. Key personnel and their assignments are normally specified in the response plan. As operations commence, adaptations may be needed in the preplanned structure of the organization. During the incident, unanticipated operations may be required, necessitating functional additions to the organization.

The positions, functions, and responsibilities at incidents vary. Major incidents require many people with a diversity of expertise and skills. For less severe incidents, fewer people and resources are needed. Key personnel and the functions they execute should be tailored to meet the needs of a particular pesticide spill incident.

Key functions that may be needed are:

- Site Control
  This includes control of the incident, response resources, and mitigation.
- Safety
  This is the safety of all operations conducted on site or in remediation.
- Security
  The need to limit access and protect others from potentially becoming exposed to the contaminants.
- Response Operations
  This requires response teams trained in mitigation procedures or are familiar with the product.
- Fire Protection
  May require utilizing the local fire jurisdiction or bring specialized equipment in with you.
- Medical Monitoring
  This requires utilizing local responders to monitor the physical health of mitigating personnel and victims of the incident.
- Record Keeping
  Documentation of all events, mitigation actions, and investigations are essential for later cost recovery and in dealing with legal issues.

**The Incident Command System**

An example of an organization to which the criteria for organizing, outlined in the preceding sections, is the Incident Command System (ICS). It is an in place command system used by the Fire Service when responding to fires, medical emergencies, rescue operations, hazardous materials incidents, and other operations. The ICS designates who is in charge (incident manager), establishes a chain-of-command, and lists key personnel and their functions.

The ICS is automatically activated when an incident, to which the fire service responds, occurs. The first arriving officer is the Incident Manager and remains so throughout the incident unless succeeded by a higher-ranking officer. Using the preexisting ICS as a framework, the Incident Manager adapts it to provide the management and organizational structure necessary to control the situation.

The size and complexity of the organization needed is dictated by the magnitude of the particular incident. Smaller incidents require fewer responders and activities.(Figure 1)

A major incident requires a larger response force with individuals performing many specialized functions.(Figure 2)

**Command Staff and Responsibilities**

- Incident Manager/Commander:
  Directly responsible for the overall incident activities. Determines manpower and other resources needed. Develops strategy for controlling the incident.

- Operations Officer:
  Responsible for management of the incident. Supervises attack operations. Briefs and receives direction from the Incident Commander.

- Safety Officer:
  Is responsible for all safety activities. Should be one of the most experienced people.

- Public Information Officer:
  Is the liaison between the Incident Commander, the news media and the public.

- Resource Officer:
  Responsible for obtaining all the resources needed to identify the material and direct corrective actions towards mitigation, compatible safety clothing, and product responses to outside forces during all phases of

the operation.

- Staging Officer:
  Determines where and arranges for areas to be used for locating equipment, supplies, additional units, and arriving personnel.

- Water Supply Officer:
  Assesses water needs and is responsible for maintaining an adequate supply of water.

- Medical Officer:
  Responsible for all the needed medical services.

- Liaison Officer:
  Is the liaison between the Incident Commander and other governmental and private organization.

- Sector Officer:
  Technical manager and supervisor for the various sectors (activities) that may be needed.

In cases where the Fire Service in not in charge of the incident, for example, a large scale natural disaster, the ICS as an entity becomes part of the organization developed in the community's disaster emergency plan. Likewise when a hazardous material incident occurs, the fire department's hazardous materials team is integrated into the overall Incident Command System. Hazardous Materials Response Team

On the local level, the Hazardous Material Response Team (HMRT) is generally associated with the Fire Service or Industry. It may be a dedicated team responding only to incidents involving hazardous materials, but usually has other associated specialized functions, for example, heavy rescue operations. Depending on the incident, the HMRT may be the only fire service unit responding. In this situation the commander of the team may also be the Incident Commander. If other units are involved, or if it is an incident of major proportions, the HMRT becomes part of the overall ICS as one of the sectors in the Table of Operations. This sector will work one of two ways within the ICS structure. Because of an incident's wide diversity and site needs, the HMRT can work as a group or part of a multi-branch organization. In either case, all HMRT operations should be relayed and discussed with operational staff to insure tactical objectives are being met.

The response team, as an entity and aside from the ICS, must be organized such that they can effectively function to control and restore the situation. The HMRT needs to have a table of organization and personnel function statement for their team paralleling the command structure of the ICS.

**Implementing Response Operations**

The release or potential release of a hazardous material requires operations that will eventually restore the situation to as near as possible to pre-incident conditions. Although each incident establishes its own operational requirements, there is a general sequence of response operations common to all responses.

Planning and implementing a response, as a minimum, requires the responders to:

- Organize: Establish an organization, select key personnel, assign responsibilities, and modify as operations proceed.

- Evaluate the situation: Based on available information, make preliminary hazard evaluation. Determine impact of incident with or without intervention.

- Develop a plan of action: Develop preliminary operations plan for collecting information, implementing immediate counter measures and rescue operations and instituting emergency actions.

- Make preliminary off-site surveys: Collect additional data to evaluate the situation (use direct reading instruments, collect samples, make visual observations). Institute emergency actions to protect public health and the environment. Identify requirements for on-site reconnaissance. Determine levels of protection, for off-site personnel, establish boundaries for contaminated areas.

- Make initial on-site reconnaissance: Collect data to determine or verify hazardous conditions and make an overall assessment of the incident. Modify initial entry safety procedures as more data is obtained. Determine Levels of Protection for initial entry team and subsequent operations.

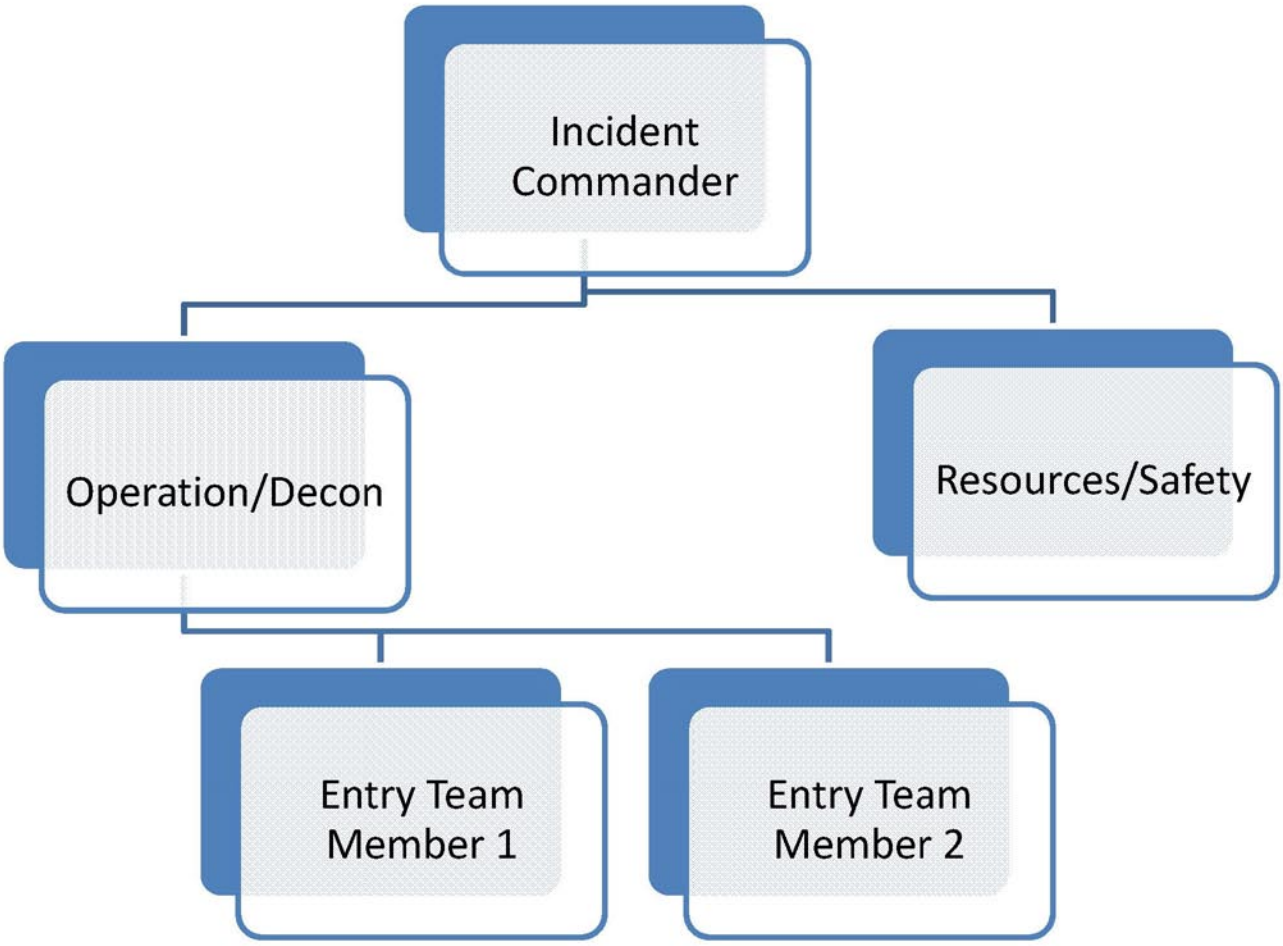
- Plan and implement site control and decontamination procedures.

- Modify original plan of action: Modify or adapt original plan based on additional information obtained during initial entries. Revise immediate emergency measures, plan long term actions, including:

    - Additional monitoring and sampling
    - Cleanup and restoration measures
    - Resource requirements
    - Site safety plans
    - Legal implications
    - Site activity documentation

Of paramount importance in any response is the safety and health of the responders. Their risk increases, as they get closer to the hazardous materials. Operations on-site must be carefully planned and executed. Before entering the immediate area of a release or potential release, as much information as possible should be collected, for example, shipping papers, placards, existing records, container labels, and other visual observations concerning types, degrees of hazard and risks which may exist.

# 5 Person IC Structure



# PERSONAL PROTECTIVE EQUIPMENT
# Chapter 03

Response personnel must wear protective equipment when there is probability of contact with hazardous substances. This includes vapors, gases, or particulates that may be generated by site activities. Full-face piece respirators protect lungs, gastrointestinal tract, and eyes against airborne toxicants. Chemical resistant clothing protects the skin from contact with skin destruction and absorbable chemicals. Equipment to protect the body against contact with known or anticipated toxic chemicals has been divided into four categories.

Level A: Should be worn when the highest level of respiratory, skin, and eye protection is needed.

Level B: Should be worn when the highest level of respiratory protection is needed, but a lesser degree of skin protection is needed.

Level C: Should be worn when a lesser level of respiratory protection is needed than level B. Skin protection criteria are similar to level B.

Level D: Should be worn only as a work uniform and not on any site with respiratory or skin hazards. It provides no protection against chemical hazards.

The level of protection selected should be based on the hazard and risk of exposure.

- Hazard
  Type and measured concentration of the chemical substance and its toxicity.

- Risk
  Potential for exposure to substances in air, splashes of liquids, or other direct contact with materials.

In situations where the type of chemical, concentration, and possibilities of contact are not known, the appropriate level of protection must be selected based on professional experience and judgement until the hazards can be better characterized.

## LEVELS OF PROTECTION

### LEVEL A PROTECTION

1. Personal protective equipment:

   - Positive Pressure self-contained breathing apparatus approved by the Mine Safety and Health Administration. (MSHA) and the National Institute for Occupational Safety and Health (NIOSH).
   - Respirators may be:
     Pressure-demand, self-contained breathing apparatus
     Pressure-demand, airline respirator
   - Fully encapsulating chemical-resistant suit
   - Coveralls*
   - Long cotton underwear*
   - Gloves (inner), and (outer) chemical-resistant
   - Boots, chemical-resistant, steel toe and shank
   - Hard hat*
   - Disposable gloves and boot covers*
   - Cooling unit*
   - 2-way radio communications (intrinsically safe)

   (*) optional

**LEVEL B PROTECTION**

1. Personnel protective equipment

   - Positive-pressure, self-contained breathing apparatus
   - Chemical-resistant clothing (includes overalls and long-sleeved jacket or hooded, one or two-piece chemical-splash suit or disposable chemical-resistant, one-piece suits). Level B may be fully encapsulating but not afford the vapor protection of Level A suits.
   - Long cotton underwear*
   - Coveralls*
   - Gloves (inner and outer), chemical-resistant
   - Boots (outer), chemical-resistance, steel toe and shank
   - Boot covers (outer)*
   - Hard hat (face shield)*
   - 2-way radio communications (intrinsically safe)

   (*) optional

**LEVEL C PROTECTION**

1. Personnel protective equipment

   - Air-purifying respirator, full-face, canister-equipped (MSHA/NIOSH approved)
   - Chemical-resistant clothing
   - Coveralls*
   - Gloves (inner and outer), chemical-resistant
   - Boots (outer), chemical-resistant, steel-toe and shank
   - Boot covers*
   - Hard hat (face shield)*
   - 2-way radio communications

   (*) optional

2. Criteria for selection

   Meeting all of these criteria permits use of level C protection:

   - Oxygen concentrations are not less than 19.5% by volume.
   - Measured air concentrations of identified substances will be reduced by the respirator below the substance's threshold limit value (TLV).
   - Atmospheric contaminants concentrations do not exceed IDLH levels.
   - Atmospheric contaminants, liquid splashed, or other direct contact will not adversely affect any body area left unprotected by chemical-resistant clothing.
   - Job functions do not require self-contained breathing apparatus.

3. Guidance on selection.

   Level C protection is distinguished from Level B by the equipment used to protect the respiratory system, assuming the same type of chemical-resistant clothing is used. The main selection criterion for Level C is that atmospheric concentrations and other selection criteria permit wearing air-purifying respirators. The continued use of air-purifying respirators (Level C) must be based on the identification of the substances contributing to the total vapor substances contributing to the total vapor or gas concentration and the application of published criteria for the routine use of air-purifying devices.

**LEVEL D PROTECTION**

1. Personnel protective equipment

    - Coveralls
    - Gloves*
    - Boots / shoes, leather or chemical splash-resistant
    - Safety glasses or chemical splash goggles*
    - Hard hat (face shield)*
    - Escape mask*

    (*) optional

2. Criteria for selection

    Meeting any of these criteria allows use of level D protection:

    - No contaminants are present
    - Work functions preclude splashes, immersion or potential for unexpected inhalation of any chemicals.

**PROTECTION IN UNKNOWN ENVIRONMENTS**

In all incident response, selecting the appropriate personnel protective equipment is one of the first steps in reducing health effects from toxic substances. Until the toxic hazards at an incident can be identified and personnel safety measures commensurate with the hazards instituted, preliminary safety requirements must be based on experience, judgment, and professional knowledge.

## EACH SITUATION MUST BE EXAMINED INDIVIDUALLY

**CHEMICAL RESISTANCE CONSIDERATIONS**

When selecting your protective clothing a primary consideration must be in the clothing's chemical resistance. This should be determined by its penetration, degradation, and permeation qualities.

- Penetration- is the transport of a chemical through design imperfections in a suit such as zippers and seams.
- Degradation- is the breakdown of the protective material due to the hazardous properties of the chemical.
- Permeation- is the sorption of a chemical through the material at the molecular level. This is measured in breakthrough time.
- Breakthrough Time- is the time a chemical comes in contact with an outside surface of a protective material until it is detected on the inside surface of the material.

Of course the ideal solution to the problem is to stay out of the product or minimize your direct exposure. To protect from splashes, the permeation rate is the main factor to consider.

Most responses to pesticides are outdoors where the ambient air temperature, wind, and topography dictate the degree of hazard as well as the level of protection to consider. Level B is usually considered by most agencies as the minimum level of protection to enter into an unknown environment for product identification outdoors. Many hazardous materials response teams recommend Level A into unknown atmospheres or confined areas.

If your responders are trained only to Level C qualifications, consider bringing in outside resources to assist in the mitigation. Contact Chemtrec, or the product manufacturer to help determine the degree of protection as well as compatible glove and suit materials to handle the incident.

Remember, minimizing the chance of exposure is the only sure way to safely handle any incident.

## Suit-Up Procedure (level “C” Protection)

Put on Saranex coated tyvek suit to waist

Put on inner boots then outer chemical boots

Tape leg cuff to boot and tab tape

Put on inner gloves and then outer chemical glove (cuff outer glove)

Slip arms through sleeve of suit

Tape sleeve cuff to chemical glove and tab tape

Attach respirator cartridges and put on respirator

Pull up hood over head

Zip up suit, fold over zipper flap and seal

If hard hat is worn, tape from shoulder over hard hat to other shoulder

# DECONTAMINATION
# Chapter 04

Personnel responding to hazardous substance incidents may become contaminated in a number of ways including:

- Contacting vapors, gases, mists, or particulate in the air.
- Being splashed by materials while sampling or opening containers. Walking through puddles of liquids or sitting or kneeling on contaminated soil.
- Using contaminated instruments or equipment.

Protective clothing and respirators help prevent the wearer from becoming contaminated or inhaling contaminants. Good work practices help reduce contamination on protective clothing, instruments, and equipment.

Even with these safeguards, contamination may occur. Harmful materials can be transferred to clean areas, exposing unprotected personnel. During removal of contaminated clothing, personnel may contact contaminants on their clothing or inhale them. To prevent such occurrences, methods to reduce contamination and decontamination procedures must be developed and established before anyone enters a site and must continue throughout site operations.

Decontamination consists of physically removing contaminants or changing their chemical nature to innocuous substances. How extensive decontamination must be depends on a number of factors, the most important being the type of contaminants involved.

The more harmful the contaminant, the more extensive and thorough decontamination must be. Less harmful contaminants may require less decontamination.

Combining decontamination, the correct method of doffing personnel protective equipment and the use of **site work zones** minimizes cross contamination from protective clothing to wearer, equipment to personnel, and from one area to another. Only general guidance can be given on methods and techniques for decontamination. The exact procedure to use must be determined after the evaluation of a number of factors specific to the incident.

### Initial Planning

The initial decontamination plan assumes all personnel and equipment leaving the **Hot Zone** (area of potential contamination) are **grossly contaminated**. A system is then set up for personnel decontamination to wash and rinse, at least once, all the protective equipment worn. This is done in combination with a sequential doffing of protective equipment, starting at the first station with the most heavily contaminated item and progressing to the last station with the least contaminated article. Each procedure requires a separate station.

Separating each decontamination station by a minimum of 3 feet further reduces the spread of contaminants during the washing/doffing process. Ideally, contamination should decrease as a person moves from one station to another further along in the line.

While planning site operations, methods should be developed to prevent the contamination of people and equipment. For example:

- Not opening containers by hand
- Using **drum grapplers**
- **Moistening** dusty areas
- **Avoiding walking** through areas of obvious contamination will reduce requirements in the decontamination procedure.

The initial decontamination plan is based on a worse case situation or assumes no information is available above the incident. Specific conditions at the site are then evaluated, including:

- Type of contaminant
- The amount of contamination
- Levels of protection required
- Type of protective clothing worn
- Type of equipment needed to accomplish the work task

**Contamination Reduction Corridor**

An area within the Contamination Reduction Zone is designated as the Contamination Reduction Corridor (CRC). The CRC controls access into and out of the Exclusion Zone and confines decontamination activities to a limited area. The size of the corridor depends on the number of stations in the decontamination procedures, overall dimensions of work control zones, and amount of space available at the site. A corridor of 75 feet by 15 feet is the minimum area for full decontamination. Wherever possible, it should be a straight path.

The CRC boundaries should be conspicuously marked, with entry and exit restricted. The far end is the hotline, the boundary between the Exclusion Zone and the Contamination Reduction Zone. Personnel exiting the Exclusion Zone must go through the CRC. Anyone in the CRC should be wearing the Level of Protection designated for the decontamination crew. Another corridor may be required for heavy equipment needing decontamination.

Within the CRC, distinct areas are set aside for decontamination of personnel, portable field equipment, removal of clothing, etc. These areas should be marked and personnel restricted to those wearing the appropriate Level of Protection. All activities within the corridor are confined to decontamination.

Personnel protective clothing, respirators, monitoring equipment, and sampling supplies are all maintained outside of the CRC. Personnel don their protective equipment away from the CRC and enter the Exclusion Zone through a separate access control point at the hotline.

**Extent of Decontamination Required**

The original decontamination plan must be adapted to specific conditions found at incidents. These conditions may require more or less personnel decontamination than planned, depending on a number of factors.

1. Type of contaminant:
   The extent of personnel decontamination depends on the effects the contaminants have on the body. All contaminants do not exhibit the same degree of toxicity. Whenever it is known or suspected that personnel can become contaminated with highly toxic or skin-destructive substances, a full decontamination procedure should followed. If less hazardous materials are involved, the procedure can be downgraded. For most pesticides strong soap and water should be used to clean contaminated clothing and skin.

2. Amount of Contamination:
   The amount of contamination on protective clothing is usually determined visually. If, on visual examination, it appears grossly contaminated, a thorough decontamination is generally required. Gross material remaining on the protection clothing for any extended period of time may degrade or permeate it.

3. Level of Protection:
   The level of protection poses different requirements in decontamination and removal of personal protective equipment.

The level of Protection and specific items of clothing worn, determine the number of stations and steps take to complete decontamination.

Clothing variations and different Levels of Protection may require adding or deleting stations in the original decontamination procedure.

4. Work Function:
   The work each person does determines the potential for contact with hazardous materials. In turn, this dictates the layout of the decontamination line. For example, observers, photographers, operators of air samplers, or others in the Exclusion Zone performing tasks that will not bring them in contact with contaminants, may not need to have their garments washed and rinsed. Others in the Exclusion Zone with a potential for direct contact with the hazardous materials will require more thorough decontamination.

5. Location of Contamination:
   Contamination on the upper areas of protective clothing poses a greater risk to the worker because volatile compounds may generate a hazardous breathing concentration both for the worker and for the decontaminating personnel. There is also a greater probability of contact with skin when doffing the upper part of clothing.

6. Reason for Leaving Site:
   The reason for leaving the Exclusion Zone also determines the need and extent of decontamination. A worker leaving the Exclusion Zone to pick up or drop off tools or instruments and immediately returning to work may not need decontamination. A worker leaving to get a new air cylinder may require some degree of decontamination. Individuals departing the contamination reduction corridor for a break, lunch, or at the end of the day, must be thoroughly decontaminated.

**Effectiveness of Decontamination**

There is no method to immediately determine how effective decontamination is. Discolorations, stains, corrosive effects, and substances adhering to objects may indicate contaminants have not been removed. However, observable effects only indicate surface contamination and not permeation into clothing. Also many contaminants are not easily observed.

In many cases, depending on the substances involved, chemical protective clothing may have to be discarded. If it cannot be determined that clothing or other items, for example, if tools and equipment have been completely decontaminated, the only safe action is to consider them hazardous wastes and have them disposed of properly.

**Procedure for Full Decontamination**

**Station 1:**

Segregated Equipment Drop

Deposit equipment used on-site.

Equipment:

- Various sized containers
- Plastic liners
- Plastic drop cloths

**Station 2:**

Outer Boot and Glove Wash

Scrub out boot covers and gloves with decon solution or detergent/water

Equipment:

- Container (20-30 gal.)
- Deacon solution
- Detergent water
- 2-3 long-handled scrub brushes

**Station 3:**

Boot Cover and Glove Rinse

Rinse off decon solution from Station 2

Equipment:

- Container (20-30 gal.)
- High-pressure spray unit
- Water
- 2-3 long-handled scrub brushes

**Station 4:**

Tape Removal

Remove tape around boots and gloves and deposit in container with plastic liner.

Equipment:

- Container (20-30 gal.)
- Plastic liners

**Station 5:**

Boot Cover Removal

Remove outer boot and deposit in container with plastic liner.

Equipment:

- Container (20-30 gal.)
- Plastic liners
- Bench

**Station 6:**

Outer Glove Removal

Remove outer gloves and deposit in container with plastic liner.

Equipment:

- Container (20-30 gal.)
- Plastic liners

**Station 7:**

Suit/Safety Boot Wash

Thoroughly wash splash suit and safety boots.

Equipment:

- Container (30-50 gal.)
- Deacon solution
- Detergent/water
- 2-3 long-handled scrub brushes

**Station 8:**

Suit/Safety Boot Rinse

Rinse off deacon solution using copious amounts of water.

Equipment:

- Container (30-50 gal.)
- High-pressure spray unit
- 2-3 long handled scrub brushes

**Station 9:**

Canister or Mask Change

Worker's canister is exchanged.

Equipment:

- New canister
- Tape
- Boot covers
- Gloves

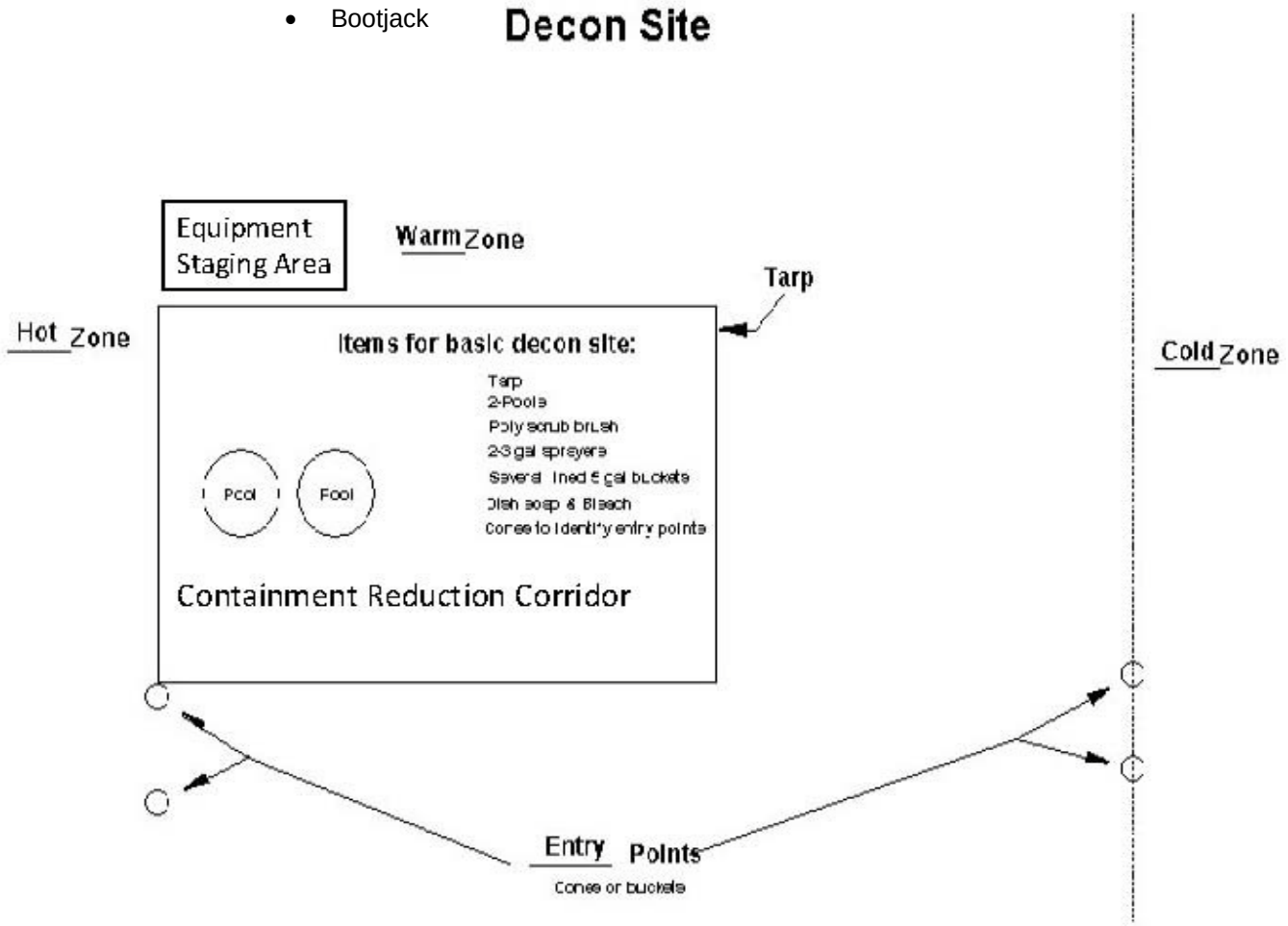
**Station 10:**

Safety Boot Removal

Remove safety boots and deposit in container with plastic liner.

Equipment:

- Container (30-50 gal.)
- Plastic liners
- Bench
- Bootjack




**Un-Suit Procedure**

(After Decon procedure)

Remove all tape and place into trash receptacle

Remove outer gloves without contaminating inner gloves

Unzip suit, place hands under hood and slide off head after hard hat is removed

Slide hand inside suit to remove it off shoulders, mushrooming suit inside-out

Remove suit down below lower thighs

Sit on chair or bucket and remove outer chemical boots

Finish removing suit, put into trash receptacle

Remove inner boots if still in-place

Remove respirator, remove filters for trash, put respirator in separate container

Remove first inner glove by pinching at wrist, pull glove off inside-out

Place a bare finger under wrist of other glove and also remove inside-out

# SPILL CONTROL CONFINEMENT AND CONTAINMENT
# Chapter 05

**Introduction**

The objective of responding to incidents involving hazardous materials is to prevent or reduce the adverse effects that a release might have on the public's health, property, and the environment. In order to mitigate (prevent or reduce) the incident's impact, the release must be controlled.

**Mitigating releases means controlling them.**
Measures to control a release involve those processes, methods, procedures, and techniques that are used to prevent or reduce the dispersement of the material or its by products into the environment. These control measures may include fire extinguishments, controlled burning, neutralization, construction of temporary dams, berms, or dikes, plugging leaking containers, misting or fogging toxic vapors or gases, use of sorbent materials, and others.

Two general control techniques frequently used by first responders are confinement and containment.

- **Confinement** consists of methods used to limit the physical size of the area of the release. Pesticides and fertilizers can be released (directly or indirectly), to air, surface water, ground water, or land surface. Deciding what to use to restrict the spread of product is dependent upon the media affected.
- **Containment** is defined as those methods used to restrict the material to its original container. Until the released materials are contained, the area of involvement will grow larger, and cleanup will become more difficult.

Controlling a release may be as simple as up righting an overturned drum leaking from its bung or turning off a leaking valve. It may be as difficult as patching a large tear in an acid tank or repairing a high-pressure transfer line. Many times, for small leaks, just shoving a wooden wedge into a hole can temporarily slow or stop a leak. Generally, highly volatile liquids and liquefied gases are the most difficult to deal with. If a tank car has been involved in an accident or if its structural integrity is suspect, then its contents may need to be transferred to another tank car. Fire might also be involved which further complicates the problem.

**Confining Hazardous Material Releases**

Techniques for confining hazardous materials depend upon whether the release is into the air, on land, into surface waters, or into the groundwater.

**A. Air Releases**

Releases of gas, vapors, or particulate into the air present a serious threat (depending particularly on the identity and quantity of chemical released). Once in the air, the material can move rapidly depending on the wind and other weather conditions, and therefore has the capability of affecting a large physical area. The cloud of material produced may be flammable, toxic, corrosive, or have other hazardous properties.

Controlling airborne materials is very difficult especially if large quantities are involved. The first step is to determine if it is possible to prevent or reduce the amount of materials from becoming airborne by containing or confining it. If this can't be done then some vapor suppression or dispersion techniques may work depending on the quantity being released. Weather conditions such as humidity, temperature, and wind speed and wind direction can greatly affect cloud formation and dispersion. If the cloud is large, then initial consideration must be given to immediately evacuating the area potentially impacted.

Air releases or suspected air releases should always be approached cautiously from the up wind direction whenever possible. Personnel must also be on the alert for changes in the wind direction. Visual observation or direct reading instruments may give some indication of the type and quantities of materials being released, and whether vapor suppression will work.

Materials that are lighter than air (vapor density less than that of the ambient atmosphere), will drift upwards into the atmosphere and be driven by the wind in a downwind direction. Heavier than air

materials will tend to hug the ground, following the contours of the land from the higher to lower elevations or be pushed by the wind movement.

**B. Land Spills**

Generally, solids (even in the form of particulates) that spill on the land are the easiest materials to confine. Even if the shipping containers rupture, solids ordinarily don't move far. The release area should be closed off to avoid having the materials tracked away from the site on shoes, clothing, or vehicle tires. It is also important not to increase the mobility of the material by the indiscriminate application of water or other liquids. Covering the material with plastic tarps, or other means can help prevent it from becoming windborne.

Liquids spilled on land may be somewhat more difficult to confine. In some cases confinement may already be in place. For example, most tank farms have a berm around their periphery for confinement of major leaks. If a transfer line breaks or if an accident occurs in transporting or loading a liquid, there will be no "automatic" containment. On concrete, blacktop, or other hard surfaces, berms can be constructed with dirt, sand, absorbents, or urethane foam packs specifically designed for this purpose. If the spill is on the ground, berms can be constructed by simply mounding the soil itself. In many cases, though, it may be more advantageous to "herd" the liquids by: ditches, swales, and berms to an existing low point or construct a catch basin. This allows the material to pool and may make cleanup easier.

There are three techniques for controlling spills on the land:

- **Diversion:** is the controlled movement of the liquid from one area to another, where the effects to human health and the environment are substantially reduced.
- **Diking:** is the use of a barrier to confine or control the movement of liquids from an area of potential harm.
- **Retention:** is the temporary confinement of a liquid in an area (e.g. in a pond) where it can be absorbed, neutralized, diluted, or pumped out.

Determining which of these three techniques should be used to confine a spill of hazardous materials depends on several factors: Time, personnel, equipment, supplies, and the potential harmful effects of the leaking material. For example, response personnel may determine that diversion rather than diking and retaining is more appropriate for controlling the movement of fuel oil that could enter a storm drain. In this situation, response personnel may determine that diversion should be used to control movement of oil because the oil is flowing toward the storm drain at a rate that will not permit the timely construction of a dike. Or, the response personnel may determine that available personnel and equipment is insufficient to construct a dike or retention pond. In many cases however, diking and retention techniques will follow the diversion technique. Diversion can begin immediately, while diking and retaining work may begin as resources arrive.

**1. Diversion**

Usually dirt is used as a barrier to divert a spilled liquid, because diversion requires that barriers be constructed in advance of the flow, using dirt from the area is practical because it is readily available, and a barrier can be quickly constructed. In order for diversion to be effective, response personnel should have a preplan for constructing diversion walls or barriers. For example, for a small barrier, each participating response person should be equipped with a hand tool for digging and a pick for breaking the ground. As the first responder breaks the ground with a pick, a second responder should place dirt on a pile, while a third responder packs the dirt tightly. This process should continue until the diversion barrier is completed. In constructing the diversion wall, the speed and the angle of the oncoming flow must be considered. For fast moving spills, angles of 60 degrees or more should be used for intercepting the spill. Generally, the greater the speed of the flow the greater the distance and angle required to slow it down. Construction equipment may be needed to build a diversion barrier if large quantities of liquids are involved. This is practical when the equipment and trained personnel are available at the scene.

**2. Diking**

Dikes can be constructed from practically any available material. The materials and manpower to construct a typical dike are usually readily available and inexpensive. Several common items are: dirt, tree limbs, boards, roof ladders, pike poles, and salvage drum covers. In a severe emergency, bagged materials such as tree bark, sand, dog food, kitty litter, and charcoal could be commandeered from a nearby food or garden store. Over time, however, both vertical and horizontal seepage through and around the dike will occur. This process can be slowed by the use of “visqueen” or “poly” plastics (a form of polyethylene). These polyethylene sheets or tarps provide a base for construction of a dike or a drainage ditch. Because some liquid materials may degrade or “eat through” plastic sheeting, response personnel must carefully select the plastic that is to be used. An alternative method to diking is to transfer the product remaining in the vessel to another container. It still may be necessary to build a dike around the original spill, while waiting for the second container to arrive.

When possible, dike construction should begin with heavier materials for reinforcement, followed by an outer layer of lighter material such as dirt. If time permits, plastic runners or salvage covers can be placed between the inner and outer walls of the dike.

The process of constructing a dike is very similar to the process of constructing a diversion barrier. Response personnel must consider the time required to confine the land spill, the resources available (i.e., response personnel and equipment), and the quantity of the hazardous material. If it is determined that diking is practical option, response personnel should consider whether to construct a dike using hand tools or power equipment. When a dike is to be constructed using heavy power equipment, the state or local highway department or appropriate contractors should be notified and arrangements made to ensure that the equipment is available and is properly used. Also, utility companies should be contacted concerning underground electrical cables or product piping to ensure that the equipment does not tear a hole in any cables or piping. The type of dike to be constructed will depend, largely on the rate that the hazardous material is moving as well as the quantity of material involved. For example, building a circle dike should confine slow moving or heavy materials. Constructing a V-shaped dike in a low area can confine faster moving products.

**3. Retaining**

In situations where materials cannot be diverted or diked, or it is not feasible to do so retention in a pit, basin or pond provides an alternative. For example, at an incident involving an overturned tank truck leaking fuel oil onto a highway, response personnel may determine that unless the fuel oil is confined, it will enter a storm drain. Because of the rate of the flow of the fuel oil and the limited number of response personnel at the scene, construction of a dike or a diversion barrier may not be practical. In this situation, retention at the drain is a workable alternative. Drain retention may involve the following processes:

a. Salvage covers or tarps should be placed over the drain and weighted down with any heavy objects.
b. If time permits, sand, stone, etc. should be shoveled onto the covers.
c. The area should be flooded with water to depth of four to ten inches. This flow should be maintained. When this process is used, a minimum amount of oil will enter the drain. Most of the oil will float on top of the water. If response personnel maintain the flow of water in the area, mostly water and a minimum amount of oil will enter the storm drain. This technique is an effective measure only for materials lighter than water or for materials that are insoluble in water. The solubility of specific materials can be obtained from material safety data sheets, chemical texts, or computerized sources.

Response personnel should consider volatile liquid characteristics and protect against air hazards that may occur when using any confinement method. For example, if volatile liquids are spilled onto the ground, an air hazard may be created. If the spill is small, response personnel need only cover the material with a salvage cover or tarp to contain the material. If the spill is large, response personnel may have to spray the material with foam in order to prevent the formation of hazardous vapors.

In some cases it may be more appropriate to retain hazardous materials in an excavated pit, pond or basin. Constructing a retention pit, pond, or basin could mean simply placing a five-gallon bucket under a dripping valve or excavating a retaining structure using construction equipment.

Like diversion barriers and dikes, whether a retaining structure may be constructed depends primarily upon the time and the resources (i.e., personnel and equipment) available for construction, and the

amount of construction needed. In an emergency, portable water tanks and “kiddy” swimming pools are alternatives that provide for a quick solution for blocking materials from entering storm drains, or for holding materials. Generally, any above ground structure offers a quicker solution than a below grade structure that must be built.

**C. Releases into water**

Releases of materials into water may be controlled using several different measures. For example, if the material in water is insoluble or slightly soluble in water and its specific gravity is greater than that of water the material will sink. A method for confinement might be an overflow dam.

An overflow dam is used to trap heavier than water material by causing the material to sink to the bottom of the stream behind the dam. When the material is trapped, relatively uncontaminated water flows over the barrier. Care, therefore, must be taken in building the barrier because if it breaks, it will release the contaminants. A depression in the waterway may be dug to trap the spilled material. Generally, however, a natural pool is used for this purpose. An overflow or confinement dam works best on slow moving and relatively narrow waterways. The faster the waterway, the less likely this method will work.

A floating boom is a confinement measure that works for a spilled material that floats and is insoluble or slightly soluble in water. Once the spilled material has been contained, it can be herded to a collection point. There it can be skimmed from the surface using several different types of skimmers. Alternatively, the spilled material can be collected for disposal by sorbents, which can be loose, in sheets or pads. In the case of a viscous liquid, straw may be used. There are several different types of booms on the market, including some which absorb the spill instead of confining it. Booms are not usually effective in rough water. Rather, booms are usually the fastest method of containment in small, slow moving streams.

Material that is highly soluble in water is very difficult to confine and contain. This is especially true in a stream that is fairly wide, deep and has a moderate to fast flow rate. In fact, even floating material is difficult to control in such a stream. For pollutants that are lighter than water (specific gravity<l), it is possible to confine and contain the material by discharging clean water into the stream while retaining the floating material. This method only works if the material is not soluble in water.

Another confinement option for water discharges is use of an under flow dam or siphon dam. An underflow dam is a dike constructed with a pipe placed lower on the upstream side and higher on the downstream side. This creates a waterway through the piping and traps the contaminants on the upstream side. As with the overflow dam, it is necessary to have additional manpower and supplies downstream, just in case the dam breaks. Hay can be used as a temporary measure to create a fixed barrier. An underflow dam is generally limited to smaller waterways, and is particularly useful for controlling and confining hazardous materials that float on the surface of the stream of water.

A filter fence is also a confinement option for water discharges involving oil. Generally, this type of fencing is difficult to set up. Items that may be used to construct a filter fence include chicken wire or any type of wire fencing. Straw or hay may also be used. However, a great deal of saturated material is generated as a result of using straw or hay that can be costly to dispose. Filter fences are typically used on faster running streams are only partially successful in removing oily contaminants. If the material spilled is soluble, there is very little that the first responder can do. If the waterway is small, the responder may install a dam that will help to recover or filter the water. The other option is to neutralize the chemical, rendering it inert. This will require the resources of the EPA and/or state environmental agency for technical assistance.

**D. Groundwater Contamination**

First responders do not usually handle groundwater contamination. Occasionally, they may be required to take samples to ensure that a release does not contaminate groundwater. Because groundwater cleanups often involve millions of dollars, any incorrect actions taken by responders may contribute to the cost of the cleanup. It is very important therefore; that response personnel take special precautions when conducting response operations to ensure that groundwater is not affected by their actions.

**CONTAINING HAZARDOUS MATERIAL RELEASES**

A variety of techniques for emergency leak containment have been developed. Most of these techniques involve the use of tools and materials that are readily available or can be made easily and inexpensively. The type of materials and tools needed to temporarily patch a leak is dependent upon the kind of container.

A practical way of determining what equipment may be required is to plan ahead. A prearranged on site visit with the facility manager, for example, can be valuable in determining what leak control problems there could be and the materials available on location for use. Leak control equipment literature, equipment used by established response teams, and a facility survey can provide the major elements of a shopping list.

**A. Primary tool kit**

Often simply tightening fittings such as bungs, caps pipes or flange bolts may control a leak. A variety of tools may be necessary to accomplish this. A basic tool kit should be carried on response vehicles and should contain, at a minimum, the following items:

- Rubber mallet
- Nylon mallet
- 18” or 24” flat blade screwdriver with plastic handle
- 18” and 36” pipe wrench
- Open end wrench set
- Box end wrench set
- Slip joint pliers (2 pairs)
- Medium weight ball peen hammer
- Linoleum knife
- Pocket knife to carve wooden plugs
- 8” vise grip pliers
- 6” pry bar or pinch bar
- Lock back knife
- Portable explosion proof hand light
- 18” to 36” bolt cutters
- Bung wrenches (2)
- Diagonal side cutting pliers
- Needle nose pliers
- Screwdriver set (common and Phillips)
- Tin snips
- Wire brush with long handle
- Hacksaw with quick disconnect for blades
- Hacksaw blades

In addition, first responders should carry other materials or at least have access to the following:

- Teflon tape available in a variety of widths and used for wrapping threads on fittings and connections.
- Steel wool - inexpensive and useful for wedging into small cracks and leaking drum
- Chimes.
- Duct tape - used to slow leakage from pipes, fittings, etc., by wrapping tightly around the affected area - also can be used as a gasket with wedges or plugs.
- Rubber sheeting (old inner tubes work well) useful as gasket material for any type of patch or plug.
- Lead foil - can be wedged into breaches -also good for wrapping wedges or plugs – or filling spaces around plugs.
- Oakum - fibrous, resin impregnated substance that swells when wet - useful as filler material or wrap on wedges and plugs.
- Wooden taper plug assortment.
- Wooden wedge assortment.
- Assorted pipe caps - can be used on threaded pipe ends.
- Bungs - used to secure drums.

- Assorted automotive clamps - used to secure rubber sheeting over pipe ends, etc.
- Assorted threaded pipe plugs - used on internally threaded pipe ends.
- Flat washers for sheet metal screws.
- Epoxy compounds - can be used as a patch or binder and filler.

Once tools are obtained, response personnel should “practice” with them to determine whether there arc any special problems. For example, if a hand tool does not have enough leverage, an extension are may have to be made from a pipe. Snap-on extension arms are also available. If a hand tool is awkward to use while wearing protective gloves, response personnel may have to enlarge the handles on the small tools and practice patching leaks and some of the plugging techniques while wearing gloves. If hand tools are difficult to see while wearing respirators and face pieces, response personnel may have to replace the face piece or color code all tools according to, for example, size. Consideration should be given to having a variety of spark proof tools.

Personnel must be able to hand carry tools and be mobile within the response area. A canvas mason’s bag can be used to hand carry the tools. Using a canvas mason’s bag to transport a limited number of hand tools within the response area frees response personnel to work on several problems at once, and ensures that only a few tools required for the job, rather than the entire tool box, are contaminated.

**B. Controlling Leaks from Drums - Equipment and Tools**

Leaking drums are a fairly common type of accident. A typical low-pressure metal drum is a flat piece of metal rolled into a tube with two capped ends. It may be welded at both ends or clamped at the top for access to the contents. A rim or lip runs around the outer edge of each end. Sometimes, various access holes are found on different drums, although typically, the main opening is found at the top. These openings or access holes are closed with a right-handed screw cap referred to as a bung. On some drums the bung is the only method of identifying the top.

Because gravity dictates that a hazardous material will follow the path of least resistance, problems may be created when a drum is accidentally breached. Providing some method of resistance to the leaking materials can control any leaks that are a result of the hole in the drum. One approach to controlling leaks in a drum is to raise the hole above the level of the liquid or solid. This can be done quickly by rolling the drum so that the hole is on top or by standing the drum on end. When minor leaks occur at openings such as the bung or lid, tightening the bung clockwise easily stops these leaks. If a bung wrench is unavailable, a long handled screwdriver can be used. Drum rim clamps can be tightened with pliers and a screwdriver if the clamp is placed properly over the rim of the drum.

If a leaking drum has to be patched, response personnel should first remove all the paint in the area of the hole in the drum to the bare metal with a wire brush. (Before creating friction with the brush, response personnel should rule out the potential for a flammable situation). Then, a wooden wedge should be driven partially into the hole with a hammer. If lead wool is available, it should be packed around the wedge so as to provide for a tight seal. The wooden wedge should then be cut flush with the drum. Next, response personnel should place aluminum tape over the wedge, and epoxy over the tape. The surface of the tape should be smoothed even with the drum.

Typically, holes or gashes in drums are the result of punctures. Often, forklifts cause these punctures. If the hole or gash is large, a plug or wedge can be used. Homemade drum clamps can also be used to patch holes up to approximately 3 inches in diameter. These drum clamps or patches consist of three parts: a neoprene gasket, a metal backing and a clamp. A drum clamp is used to patch a hole in a drum in the following manner:

1. Bend the end tab of a one-piece, T-shaped sheet metal backing over the main section.
2. Insert the clamp strap through the slot that was made by bending over the tab on the sheet metal backing. (The strap is a large version of a simple radiator hose clamp).
3. Glue the neoprene gasket directly to the sheet metal backing to make the seal once the patch is in place.
4. Place the clamp around the drum, putting the patch over the hole, and tighten the clamp.

Because patching holes in drums may be frequently done by responders at hazardous materials incidents, it is recommended that a number of drum clamp patches of varying sizes be made in advance

and carried in a kit on the response vehicle. Small punctures or pinhole leaks can be stopped by inserting a sheet metal screw with one or more washers and a rubber gasket into the hole. Other methods for plugging small holes include boiler plugs, vulcanizing repair kit (tire patches), and rubber plugs. All of these items are available at plumbing and automobile part stores. Response personnel may also perform a “drum to drum transfer.” This method involves hand pumping the contents of a damaged drum into a new, empty drum, or into a drum containing the same material.

Usually, more sophisticated plugs and patches are readily available or can be locally manufactured from sheet metal with rubber gasket material and toggle bolts (T-patches). They can be fabricated in a variety of sizes. Each works well on different types of container breaches. The only limiting factor, the fissure must be large enough for the toggle to pass through. These devices should not be snugged down too tightly because the toggles will not tolerate a great deal of torque. For devices that can be applied using more torque, a T-bolt may substitute for the toggle bolt. But once again, too much torque can pull the “T” through thin walled containers. Successfully patched drums should be removed from normal service and placed inside a recovery drum (also referred to as a over pack) designed to fit over the damaged container. Additional protection is obtained by first placing the damaged drum inside a large polyethylene bag. The final package must be clearly marked so receivers at its destination are made aware of the hazardous material stored inside. Failure to mark the recovery drum could be in violation of state and federal regulations. Properly packaged recovery drums will be suitable for transportation to a recycling facility or waste dump.

**Spills Less Than 1 Gallon**

1. DEVELOP a plan of action.
2. Shut off the source of spill remotely if possible or locally with proper protective equipment.
3. Put on appropriate PERSONAL PROTECTIVE EQUIPMENT, use adequate containment materials.
    a. Spills outside or spills in a well ventilated area: wear proper protective equipment, i.e., full face respirator and gloves, coveralls, and boots, before attempting to clean up a spill, use non-sparking tools.
    b. Spills in an unventilated area, i.e., SCBA, gloves, coveralls, and boots before attempting to clean up a spill. Use non-sparking tools.
4. If skin or eye contact with chemicals occurs, take appropriate first aid measures. Personal health takes priority over continued spill cleanup.
5. SALVAGE any equipment, as appropriate.
6. DECONTAMINATE, CLEAN AND REPAIR all personal protective equipment and emergency equipment. Do NOT resume operations until all such equipment is operational.
7. All cleanup personnel should thoroughly decontaminate prior to returning to normal duties.
8. Maintain records of all spill recovery actions taken.
9. Take proper corrective action before restarting the facility.

**Spill Management Media**

“What to use to clean it up”

The actual medium used to absorb liquid spills will depend upon the nature and identity of the spilled material and the procedures to be used for fighting the spill. In this section, absorption techniques and neutralization techniques will be examined. The advantages and problems of each will be described. The detailed nature of some absorbents will be examined, along with experimental data describing their behavior. This information is necessary to understand how to properly select the method and medium with which to fight a spill.

The two general approaches to fighting a spill are: **CHEMICAL INACTIVATION AND ADSORPTION**

Chemical inactivation usually involves performing some chemical reaction that renders the spilled material less hazardous (preferably NON-HAZARDOUS) and then removing the residue by any appropriate method. Absorption refers to soaking up the liquid onto a medium such as vermiculite or sand, without changing the

chemical identity. Saw dust can be used and is a good absorbent material for products that will need to be disposed of by incineration.

Neutralization requires specific knowledge of chemistry and preplanning. Heat is frequently a by-product of the chemical reaction and must be considered. Some examples of neutralization are:

- Inorganic acids with caustic soda
- Inorganic bases with citric acid
- Organic acids with caustic soda
- Acid halides with water followed by caustic soda

In all cases where this approach is used, care must be taken to prevent the mixture from becoming a more serious problem than the original spill.

The advantages of neutralization are that it (ideally) produces a non-toxic and no-hazardous waste, the spilled material is easy to clean up and personal exposure is minimized. (It is our recommendation that nay spill residue produced from a hazardous material be treated as a RCRA hazardous waste, regardless of any neutralization performed).

In general, absorbent spill media has the properties of: non-reactive, multipurpose, and efficient.

Vermiculite, for example, is non-reactive to most materials. Hydrofluoric acids and related compounds are the exception. It will absorb approximately seven pounds of liquid per pound of dry material and is thus efficient and cost effective. Sand has the same chemical limitation as vermiculite, but is heavier and less efficient. It is usually readily available.

Absorbents tend to increase the vapor pressure of volatile compounds, thus increasing the potential for exposure. This also increases the danger of fire, if the spilled material is flammable. Great care must be practiced when using this type of material.

The following spill control media may be used under different circumstances with different chemicals to contain, control, neutralize or otherwise manage a spill. Your instructor will discuss their individual uses, advantages, disadvantages and limitations.

- Sand, Vermiculite, oil dry.
- Safestep, Solusorb, Absorbent pillows
- Lime, foams, vinegar, and bleach

## CHEMICAL

This is an aid to help remember the steps to a spill response. Just think of each letter of the word.

**C** **CLEAR** affected area / **CONTACT** emergency assistance / **CHECK** for involved personnel

**H** Determine the **HAZARDS** by (1) identifying the material, (2) determining the quantity released, and
(3) determining the location.

**E** Use proper Personal Protective **EQUIPMENT**

**M** Use the proper spill **MEDIA**

**I** **INSPECT** spill responders for personal safety

**C** **CLEANUP** and **CONTAINERIZE** the spill residue

**A** **ANALYZE** area for containment

**L** Prepare required **LETTERS** and reports

# EMERGENCY CLEAN-UP KITS

## EMERGENCY PHONE NUMBERS

1. BRANCH OR OFFICE NUMBER _____

2. 24 HOUR EMERGENCY NUMBER _____

3. CHEMTREC 1-800-424-9300

4. FIRE DEPARTMENT _____

## BRANCH KIT

Each branch kit contains most of the equipment necessary to contain and neutralize most organophosphate / carbamate pesticide spills.

- Copy of Spill response procedures
- 16 gallon drum
- Brooms and dust pans
- 16" squeegee
- Poly scoop shovel
- Salvage drums
- 2 to 3 gal hand sprayers
- Collapsible shovel
- Spill control medium
- Disposable respirator
- Goggles, gloves, boots
- 4 Poly tarps (12' x 18')
- Permanent marking pens
- Two boxes small garbage liners
- Largest size garbage liners
- Kiddie pools
- Placard, labels, SDSs
- Disposable coveralls
- 6 each poly bags
- Barricade tape
- 10 rolls of duct tape
- Spade shovel
- Long handled poly brushes
- First aid kit
- 1 quart of bleach
- 1 pint isopropyl alcohol
- 1 pint detergent
- 8.8 lbs lime
- 2 large sponges
- PT3 soap and water
- Glove liners
- 8 to 10 five gallon pails
- Traffic cones
- Pens, pencils, note paper

# FIRST AID FOR PESTICIDE POISONING
# Chapter 06

Pesticides are necessary for the production of adequate quantities of food and fiber for a continuously growing population. They are used to protect both human and animal health, reduce populations of forest pests and control weeds, diseases and insects of crops. If we hope to retain these useful chemicals, we must learn to use them properly and safety. Pesticides can kill or poison man and animals and harm the environment. Most poisonings result from careless use, improper storage or ignorance of the user. Children under 10 years of age are victims of at least half of the accidental pesticide poisonings in this country. Accidents with pesticides can be reduced if a few basic safety rules are followed.

**Read and Follow Instructions**

The most important rule to follow when using pesticides is: **Read and follow** the instructions and precautions on the label. Read the label **before** buying the product, **before** opening the container, **before** mixing the solution, **before** applying the solution and **before** disposing of unused portions of the solution or disposing of empty containers. Be sure to wear the protective clothing and use the protective devices specified on the label.

Besides giving instructions for use and safety precautions, the label has one of three "signal words" that show how dangerous or toxic the contents are to man.

- **Danger/Poison** - most dangerous
- **Warning** - moderately dangerous
- **Caution** - least dangerous

Danger is the most toxic of agriculture chemicals. Acute oral **lethal dose is from 5 to 50 mg/kg** of body weight. (Taste to a teaspoon full).

Warning labels indicate moderately toxic ag chemicals. An acute **lethal dose is from 50 to 500 mg/kg** of body weight. (Teaspoon to a tablespoon).

Caution labels indicate mildly toxic agricultural pesticides. An **acute lethal dose is from 500 to 5000 mg/kg** of body weight. (1oz. to 1 pint).

**Chemical Exposure**

Pesticides enter the body in three ways:
1. Ingestion (through the mouth)
2. Injection (through the skin)
3. Inhalation (through the respiratory system)

Most pesticide poisonings occur through skin exposure.

**Systemic Organophosphate and Carbamate Poisoning**

Symptoms and signs of systemic organophosphate and carbamate poisonings are almost entirely due to cholinergic manifestations. They include both muscarinic and nicotinic effects and are the result of acetylcholine accumulation.

Early symptoms depend on the route of absorption and the severity of the intoxication:
- Gastric symptoms appear earlier if the material has been ingested.
- Shortness of breath, salivation, and excessive bronchial secretions occur if the material has been inhaled.
- With dermal exposure, gastrointestinal and respiratory symptoms appear at the same time.
- In children, a convulsion may be the first symptom.
- In serious intoxication, both muscarinic and nicotinic symptoms begin shortly after exposure.

With involvement of the muscles of respiration, further respiratory failure occurs from bronchial constriction, blockage by secretions, and depression of the respiratory center.

Central nervous signs and symptoms include anxiety, restlessness, giddiness, headaches, drowsiness, convulsions, and coma.

In the advanced state, the patient is pale, sweating, and frothing at the mouth. The pupils usually are miotic and non-responsive to light. Pupils will sometimes be dilated if the patient is in extremis. They will then become miotic with initial treatment.

The most important neurological findings are:

- Fasciculation - localized and generalized involuntary twitching may be elicited by tapping the muscles over the cheekbone, over the thorax, or on the arms.
- Sometimes generalized cloni-seizures may be observed.
- Miosis - the pupil is small, usually less than 5 mm. The diameter of the pupil in millimeters should be recorded.
- Metabolic signs and symptoms include the following:
  - Blood sugar may be elevated at first, the levels of hyperglycemia is much less than the levels observed with diabetic coma.
  - Serum electrolytes are usually normal.
  - Fever is not a constant finding. The patient's temperature is usually normal, though severe dehydration may occasionally cause fever.

**Carbamate Insecticides:**

While many of the systems of poisoning are similar to organophosphates the inhibition of Cholinesterase is reversible and does not require the use of pralidoxime as part of the medical treatment.

**Symptoms and Signs**

Symptoms and signs compatible with cholinergic excess are the second most important variables contributing to the clinical diagnosis of anticholinesterase poisoning.

Although symptoms of cholinergic poisoning may be easily confused with those of other conditions, a pesticide cause should always be considered. Physical signs are less subject to misinterpretation. Miosis is a rare condition in the clinic setting. It should always lead to first consideration of exposure to anticholinesterase pesticide. Miosis is doubly significant if it is accompanied by nicotinic and muscarinic symptoms and muscle fasiculations. These signs, together with the general appearance of the patient, should prompt the nurse and the physician to a diagnosis of organophosphate poisoning.

If the patient has anticholinesterase poisoning, large doses of atropine are required to produce these normal reactions.

**Differential Diagnosis**

**Mild anticholinesterase** poisoning causes such symptoms as:

- Headaches
- Fatigue
- Dizziness
- Blurred vision
- Excessive sweating
- Nausea and vomiting
- Stomach cramps
- Diarrhea
- Salivation

**Moderately Severe** poisoning causes all of the symptoms found in mild poisoning, but in addition, the patient:

- Is unable to walk
- Often complains of chest discomfort and tightness

- Exhibits marked miosis
- Exhibits muscle twitching

**Severe** poisoning results in:

- Unconsciousness
- Local or generalized seizures

**General First Aid**

The general first aid for pesticide poisoning is:

1. Establish a clear airway and administer oxygen, removal of secretions by suction may be necessary
2. Remove the patient from further contact with the chemical itself, toxic smoke, or runoff water
3. Decontaminate the patient with detergent and lots of water if there is any possibility that skin or hair has been contaminated
4. Monitor vital signs while transporting the patient to competent medical help. Cardiopulmonary resuscitation may become necessary for an acutely poisoned patient. Do not leave the patient alone
5. Rescue personnel must avoid contamination with toxic materials in vomit or on the patient during decontamination, resuscitation, and transport. Wear rubber gloves

In addition, for organochlorine poisoning, keep the patient from excessive sensory stimulation - such as lights or sirens.

In the event of nitro or chlorophenol poisoning, reduce the body temperature by physical means such as sponge baths or wet sheets.

In all cases of eye contact, flush with clear water immediately for at least 15 minutes and get medical attention. Delay of a few seconds in flushing the eyes with water greatly increases the extent of injury.

**If the victim is conscious:**

1. Remove him from the contaminated area, to a quite, cool, and well-ventilated area.
2. Lay him down with his legs raised, if his face is pale. Lay him down flat on his back with his head turned to side and his legs raised, if his face is red.
3. Loosen restrictive clothing.
4. Cover him with a blanket.
5. Speak reassuringly to him.
6. Notify a physician and inform him of the nature of the substance involved.

**If the victim is - conscious but has difficulty in breathing or is unconscious but breathing:**

1. Notify a physician and inform him of the nature of the substance and the state of the victim.
2. Lay him down with his legs slightly raised.
3. Remove dentures or partial plates.
4. Loosen restrictive clothing.
5. Cover him with a blanket

**If the victim is no longer breathing:**

1. Act quickly, begin artificial respiration or mouth-to-mouth resuscitation **AS QUICKLY AS POSSIBLE**
   *Avoid Chemical Contamination
2. Continue this treatment until the physician arrives.

**In case of burns and in the absence of a physician:**

1. Apply a dry sterile dressing.
2. Dress the victim in clean clothes or cover him with a blanket.
3. Take him to the hospital.

**If the victim is in a state of shock:**

1. Cover him with a blanket.
2. Transport on a stretcher, lying on his back.
3. Monitor vital signs

# GLOSSARY OF COMMON SDS TERMS

**Absolute:** A chemical substance that is not mixed: pure. An example is Absolute Alcohol-which is ethyl alcohol containing not more than one percent by weight of water.

**Absorption:** The penetration of matter in bulk into other matter, as in the dissolving of a gas into a liquid.

**Absorption Barrier:** Any of the exchange barriers of the body that allow differential diffusion of various substances across a boundary. Examples of absorption barriers are the skin, lung tissue, and gastrointestinal tract wall.

**ACGIH: A**merican **C**onference of **G**overnmental and **I**ndustrial **H**ygienists.

**Acid:** A substance having a pH less than 7. Also, a substance that releases hydrogen ions.

**Acute Effect:** An adverse effect on a human or animal body with severe symptoms developing rapidly and coming quickly to a crisis.

**Acute Toxicity:** The adverse (acute) effect resulting from single dose of ,or exposure to, a substance. Ordinarily used to denote effects in experimental animals.

**Adsorption:** The surface retention of solid, liquid, or gas molecules, atoms, or ions by a solid or liquid.

**Alkaline:** A substance having a pH greater than 7. Also, a substance that releases Hydroxyl ions (OH).

**Anhydrous:** Free of water.

**ANSI: A**merican **N**ational **S**tandards **I**nstitute.

**API: A**merican **P**etroleum **I**nstitute

**Aqueous:** A water based solution.

**Asphyxiant:** A vapor or gas which can cause unconsciousness or death by suffocation (lack of oxygen). Most simple asphyxiants are harmful to the body only when they become so concentrated that they reduce oxygen in the air (normally about 21%) to dangerous levels (18% or lower).

**ASTM: A**merican **S**ociety for **T**esting and **M**aterials.

**Autoignition:** The minimum temperature to which a substance must be heated without application of an ignition source in order to cause that substance to ignite.

**Boiling Point:** The temperature at which a liquid changes to a vapor, at a given pressure. (760mmHg, or one atmosphere, or 14.7 psia). The vapor pressure of the liquid is equal to the prevailing pressure of the atmosphere.

**Breakthrough Time:** The time taken in standard tests for permeation of a chemical through a protective barrier (such as a rubber glove) to be detected.

**Btu: B**ritish **T**hermal **U**nit. The amount of heat required to raise the temperature of one pound of water one degree Fahrenheit.

**Ceiling:** The maximum allowable human exposure limit for an airborne substance; not to be exceeded even momentarily.

**CAA: C**lean **A**ir **A**ct

**Calorie:** The amount of heat required to raise the temperature on one gram of water one degree Celcius.

**Carcinogen:** A substance or agent capable of causing or producing cancer in mammals.

**CAS: C**hemical **A**bstracts **S**ervice

**Catalyst:** A substance that initiates a chemical reaction and allows it to proceed under different conditions than otherwise possible.

**cc, $cm^3$: C**ubic **C**entimeter.

**Celsius:** A scale for measuring temperature where water boils at $100^o$ and freezes at $0^o$.

**Chemical Family:** A group of single elements or compounds with a common general name.

**CHEMTREC: Chem**ical **Tr**ansportation **E**mergency **C**enter; a national center established to relay pertinent emergency information concerning specific chemicals on request. (1-800-424-9300)

**Chromatogram:** The record produced by the gas liquid chromatograph.

**Chronic Health Effect:** An adverse effect on a human or animal body, with symptoms that develop slowly over a long period of time.

**Chronic:** Adverse health effects resulting from repeated doses of, or exposures to, a substance over a relatively prolonged period of time.

**CWA: C**lean **W**ater **A**ct

**CO:** Carbon monoxide, a colorless, odorless, flammable and very toxic gas produced by the incomplete combustion of carbon.

**$CO_2$:** Carbon dioxide, a heavy, colorless gas, produced by combustion and decomposition of organic substances.

**COC: C**leveland **O**pen **C**up, a flash point test method.

**Combustible:** A term used by NFPA, DOT, and others to classify certain liquids that will burn, on the basis of flash point. (Above $100^o$F and below $200^o$F by NFPA & DOT)

**Concentration:** The relative amount of a substance when combined or mixed with other substances.

**Corrosive:** A substance that erodes and deteriorates materials, such as metals, fabrics, and human tissue, upon contact.

**CPSC: C**onsumer **P**roducts **S**afety **C**ommission.

**Cutaneous:** Pertaining to the skin.

**Decomposition:** Breakdown of a material or substance into parts or elements or simpler compounds.

**Density:** The mass of a substance divided by its volume, or the mass of a substance per unit volume.

**Dermal:** Used on or applied to the skin.

**Dermal Toxicity:** Adverse effects resulting from the skin's exposure to a substance.

**Dermatitis:** Inflammation of the skin

**DHHS:** U.S. **D**epartment of **H**ealth and **H**uman **S**ervices.

**Dose:** The amount of a substance available for interaction with metabolic processes or biologically significant receptors after crossing the outer boundary of an organism.

**DOT:** U.S. **D**epartment **o**f **T**ransportation.

**EPA:** U.S. **E**nvironmental **P**rotection **A**gency.

**Epidemiology:** The science which deals with the study of disease in a general population.

**Etiologic Agents:** Microscopic organisms such as bacteria or viruses, which can cause disease.

**Evaporation Rate:** The rate at which a particular material will vaporize when compared to the rate of vaporization of a known material (usually Butyl acetate).

**Explosive:** A material that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

**FDA:** U.S. **F**ood and **D**rug **A**dministration.

**FIFRA: F**ederal **I**nsecticide, **F**ungicide, and **R**odenticide **A**ct.

**Flammable:** Describes any solid, liquid, vapor, or gas that will ignite easily and burn rapidly. A “flammable liquid" is defined by the NFPA and DOT as a liquid with a flash point below 100o F and A "flammable solid" defined as a solid that will ignite readily and burn vigorously and persistently.

**Flammable Limits:** The Lower Explosive Limit (LEL) and the Upper Explosive Limit (UEL)

**Flash Point:** The lowest temperature at which a liquid will give off enough vapor at or near its surface to form an ignitable mixture with air.

**Formula:** The conventional scientific designation for a material.

**g:** Gram; a metric unit of weight.

**g/kg:** Grams per kilogram, an expression of dose, indicating the grams of substance per kilogram of body weight.

**General Exhaust:** A system for capturing and exhausting air contaminants from the work area in general.

**Hazardous Material:** Any substance or mixture having properties capable of producing adverse effects on the health of a human being.

**Hepatotoxin:** A substance capable of causing liver damage.

**Hydrocarbon:** An organic compound containing carbon and hydrogen.

**Hypoxia:** A condition defined by a low supply of oxygen.

**IDLH: I**mmediately **D**angerous to **L**ife and **H**ealth. The concentration representing the maximum level of a pollutant from which an individual could escape within 30 minutes without escape impairing symptoms or irreversible health effects.

**Ignitable:** Capable of being set afire.

**Incompatible:** Materials that could cause dangerous reactions from direct contact with one.

**Ingestion:** The taking in of a substance through the mouth.

**Inhalation:** The breathing in of a substance in the form of a gas, vapor, fume, mist or dust..

**Inhibitor:** A chemical which is added to another to prevent an unwanted chemical change.

**Inflammation:** A series of reactions produced in the tissues by an irritant, injury, or infection characterized by redness and swelling caused by an influx of blood and fluids.

**IOSH:** The **I**nstitute for **O**ccupational **S**afety and **H**ealth.

**Irritant:** A substance, which, by contact in sufficient concentration for a period time, will cause an inflammatory response of the eye, skin, or respiratory system.

**Kelvin:** A unit of temperature related to the triple point of water.

**Kg:** Kilogram; a metric unit of weight.

**L: Liter**; a metric unit of capacity.

**LC:** Lethal concentration.

**LC50: L**ethal **C**oncentration 50; the concentration in air, which is expected to kill 50% of a group of test animals.

**LD: L**ethal **D**ose.

**LD50: L**ethal **D**ose 50; a single dose of material, which is expected to kill 50% of a group of test animals.

**LEL or LFL: L**ower **E**xplosive **L**imit or **L**ower **F**lammable **L**imits of a vapor or gas. The concentration of flammable vapor in air, or oxygen, below which a flame will not propagate when, provide with an ignition source.

**LOAEL: L**owest **O**bserved **A**dverse **E**ffect **L**evel

**Local Exhaust:** A system for capturing and exhausting contaminants from the air at the point where they occur.

**$m^3$:** Cubic meter; about 35.3 cubic feet or 1.3 cubic yards.

**MCL: M**aximum **C**ontaminant **L**evel

**MDL: M**edian **L**ethal **D**ose

**MEL: M**aximum **E**xposure **L**imit. The maximum permitted concentration of a chemical to which a worker may be exposed over an extended period of time.

**Melting point:** The temperature at which a solid substance changes to a liquid form. The solid and liquid phases are in “equilibrium”.

**Mechanical Exhaust:** A powered device, such as a motor-driven fan for exhausting contaminants from a workplace.

**Mg:** Milligram; a metric unit of weight.

**Mg/kg:** Milligrams per kilograms. One part per million.

**Mg/$m^3$:** Milligrams per cubic meter.

**Micron:** One millionth of a meter.

**mL:** Milliliter; a metric unit of capacity.

**mmHg:** Millimeters of mercury (Hg)

**mppcf:** Million particles per cubic foot; a unit of measurement of particles in air.

**Molecular Weight:** The sum of the atomic weights of all the atoms that constitute a molecule.

**MRL: M**inimum **R**isk **L**evel.

**MSHA:** The **M**ining **S**afety and **H**ealth **A**dministration.

**Mutagen:** A substance or agent capable of altering the genetic material in a living cell.

**$N_2$:** Nitrogen

**Nanogram (ng):** One billionth of a gram ($10_{-9}$).

**Nanometer (nm):** One billionth of a meter ($10^{-9}$).

**NaOH:** Sodium Hydroxide, or caustic acid.

**Nausea:** Tendency to vomit, feeling of sickness at the stomach.

**NRC: N**ational **R**esponse **C**enter (1-800-424-8802)

**NBUAC, or n-BuAc:** Normal butyl acetate

**Nephrotoxin:** A chemical which may cause kidney damage.

**Neurotoxin:** A chemical whose primary action is on the Central Nervous System (CNS)

**NFPA: N**ational **F**ire **P**rotection **A**ssociation

**NIOSH: N**ational **I**nstitute for **O**ccupational **S**afety and **H**ealth of the Public health service, U.S. Department of Health and Human Services (DHHS).

**NOAEL: N**o **O**bserved **A**dverse **E**ffect **L**evel

**NOx:** Oxides of nitrogen.

**Nuisance Material:** Material which can cause transient irritation or discomfort, but with no long term or systemic effects.

**Odor Threshold:** The lowest concentration of a vapor in air which can be detected by smell.

**OEL: O**ccupational **E**xposure **L**imit. A generally legally enforceable limit on the amount or concentration of a chemical to which workers may be exposed.

**OES: O**ccupational **E**xposure **S**tandard.

**Olfactory:** Relating to the sense of smell.

**Oral:** Used in or taken into the body through the mouth.

**Oral Toxicity:** Adverse effects resulting from taking a substance into the body via the mouth.

**OSHA:** Occupational Safety and Health Administration of the U.S. Department of Labor.

**Oxidation:** A reaction in which a substance combines with oxygen provided by an oxidizer or oxidizing agent.

**Oxidizer:** DOT defines an oxidizer as a sub-stance that yields oxygen readily.

**Oxidizing Agent:** A substance which supports or causes combustion of other materials.

**PEL: P**ermissible **E**xposure **L**imit. A time-weighted average established by OSHA.

**% Volatile:** Percent volatile by volume; the percentage of a liquid or solid that will evaporate at an ambient temperature (70 degrees F).

**pH:** The value that represents the acidity or alkalinity of an aqueous solution.

**PMCC:** Pensky-Martens Closed Cup; a flash point test method.

**Polymerization:** A chemical reaction to which one or more small molecules combine to form a larger molecule.

**ppb:** Parts per billion; a unit for measuring the concentration of a gas or vapor in air or other contaminants in soil or water.

**ppm:** Parts per million; a unit for measuring the concentration of a gas or vapor in air or other contaminants in soil or water. Can be expressed as mg/Kg.

**psi:** Pounds per square inch; a unit for measuring the pressure a material exerts on the walls of a confining vessel.

**RCRA:** Resource Conservation and Recovery Act

**Reaction:** A chemical transformation of change.

**Reactivity:** A description of the tendency of a substance to undergo chemical reaction with the release of energy.

**Reducing Agent:** In a reduction reaction the reducing agent is the chemical or substance which (1) combines with oxygen; or (2) loses electrons to the reaction.

**REL: R**ecommended **E**xposure **L**imit. NIOSH recommended exposure limit for an 8 or 10 hour time weighted average exposure and/or ceiling.

**Reproductive Toxin:** A chemical which may cause birth defects or sterility.

**Respiratory System:** The breathing system. It includes the lungs and air passages (trachea or “windpipe”. Larynx. Mouth. And nose), as well as the associated nervous and circulatory supply.

**RfC:** Inhalation **Ref**erence **C**oncentration. An estimate of the daily exposure of the human population to a chemical, through inhalation, that is likely to be without risk of deleterious effects during a lifetime.

**RfD:** Oral **R**eference **D**ose. An estimate of the daily exposure of the human population to a chemical, through ingestion, that is likely to be without risk of deleterious effects during a lifetime.

**RTECS Number:** An identification number set by the U.S. **R**egistry of **T**oxic **E**ffects and **C**hemical **S**ubstances.

**SDS: S**afety **D**ata **S**heet

**Sensitizer:** A substance, which on first exposure causes little or no reaction, but on repeated exposure may cause marked response not limited to the contact site.

**SETA:** Setaflash Closed Tester, a flash point test method.

**"Skin":** A notation used to indicate possible significant contribution to overall exposure to a chemical by way of absorption through the skin, mucous membranes, and eyes by direct or airborne contact.

**Skin Sensitizer:** See "Sensitizer".

**Skin Toxicity:** See "Dermal Toxicity".

**Solubility:** A term expressing the percentage of a material (by weight) that will dissolve in water at ambient temperature.

**SOx:** Oxides of sulfur.

**SOP: S**tandard **O**perating **P**rocedures

**Species:** A biological types; on MSDS's, species refers to the test animals.

**Specific Gravity:** The ratio of the weight of one substance compared to the weight of an equal volume of another material, which is used as a standard. Normally, liquids are compared to water; gases are compared to air.

**Specific Heat:** The ratio of the heat capacity of a substance to the heat capacity of water; or the quantity of heat required for one-degree temperature change in a unit of weight of material.

**Specific Volume:** The volume occupied by a unit mass of a substance.

**Stability:** An expression of the ability of a material to remain unchanged, for MSDS purposes, a material is stable if it remains in the same form under expected and reasonable conditions of storage or use.

**STEL:** Short Term Exposure Limit.

**Synonym:** Another name or names by which a material is known.

**Systemic Poisons:** Materials which have an effect remote from the entry into the body.

**TCC: T**ag (Tagliabue) **C**losed **C**up; a flash point test method.

**TD50:** The chronic dose rate in mg/kg body weight per day which would induce tumors in half the test animals at the end of a standard lifespan for the species.

**Teratogen:** An agent or substance that can cause physical defects in the developing embryo.

**TLV: T**hreshold **L**imit **V**alue; a term used to express the airborne concentration of a material to which nearly all persons can be exposed day after day without adverse effects.

**TLV - TWA: T**hreshold **L**imit **V**alue – **T**ime **W**eighted **A**verage.

**TLV - STEL: T**hreshold **L**imit **V**alue - **S**hort **T**erm **E**xposure **L**imit. The maximum concentration for a continuous exposure period.

**TLV-C: T**hreshold **L**imit **V**alue-**C**eiling Exposure Limit is the concentration that should not be exceeded even instantaneously

**TOC: T**AG **O**pen **C**up; a flash point test method.

**Toxic:** A substance that has the ability to produce injurious or lethal effects through its chemical interaction with the body.

**Toxicity:** The sum of the adverse effects resulting from exposure to a material.

**Trade Name:** The trademark name or commercial trade name for a material.

**TSCA: T**oxic **S**ubstance **C**ontrol **A**ct. This act regulates the manufacture, transport and use of toxic substances in the United States.

**TWA: T**ime **W**eighted **A**verage. An allowable exposure concentration averaged over a normal 8 hour workday or a 40 hour workweek.

**UEL or UFL: U**pper **E**xplosive **L**imit or **U**pper **F**lammable **L**imit of a vapor or gas. The concentration of flammable vapor in air, or oxygen above, which a flame will not propagate when, provide with an ignition source.

**Unstable:** Tending toward decomposition or other unwanted chemical change during normal handling or storage.

**USDA:** U.S. Department of Agriculture.

**Vapor Density:** The weight of a vapor or gas com-pared to the weight of an equal volume of air; an expression of the density of the vapor or gas.

**Vapor Pressure:** The pressure exerted by a substance's vapor above it's own liquid in a closed container. **A)** Vapor pressure of a substance at 100 degrees F. will always be higher than the vapor pressure of the substance at 68 degrees F. **B)** Vapor pressures reported on MSDS's in mmHg are usually very low pressures; 760 mmHg is equivalent to 14.7 pounds per square inch. **C)** The lower the boiling point of a substance, the higher its vapor pressure.

**Ventilation:** See "general exhaust"," local exhaust", and "mechanical ventilation".

**Viscosity:** Measurement of the flow properties of a material.

**VOC: V**olatile **O**rganic **C**ompounds

## PERSONAL PROTECTIVE EQUIPMENT (**PPE**) BAGS and FACILITY SPILL KIT

**PPE** items for each employee that uses PPE in his/her routine work duties or would be required to use PPE in an emergency response:

| | |
|---|---|
| One (1) ea | Full-face respirator with all appropriate cartridges or canisters |
| Two (2) pr. | Saranex coated Tyvek coveralls with attached hood or equivalent |
| Two (2) pr. | Unlined chemical-resistant gloves (other types for specific uses) |
| One (1) pr. | Chemical resistant, rigid boots to be pulled over work shoe |
| Six (6) pr. | Inner gloves |
| Six (6) pr. | Boot liners (small poly garbage can liners) |
| One (1) ea | Hard hat/bump hat with attachable face shield |
| One (1) pr. | Unvented (vapor proof) goggles |
| One (1) pr. | Cloth or paper disposable coveralls |
| One (1) roll | Duct tape (2-3”) |
| Six (6) ea | Large heavy-duty poly trash can liners |
| One (1) qt. | Eyewash |
| One (1) ea | Soap or hand cleaner |
| One (1) roll | Paper towels or equivalent disposable towel |
| One (1) ea | Carrying bag or container for PPE |

**Optional Items**:

| | |
|---|---|
| 100 ft. roll | Barrier/Caution tape |
| Several | Chemical Call Report Forms (may be stored in Accident Report envelope) |
| One (1) ea | CPR personal protective mouth piece |
| One (1) ea | note pad, pen, permanent marker |

**BASIC FACILITY SPILL KIT** items for branches, all branches not assigned a Major Spill Kit.
Kit to be stored in a secured box designed to be loaded with a forklift, inside the chemical warehouse near an overhead door or outside, protected from the weather.

| | |
|---|---|
| Two (2) ea | Full-face respirators with all appropriate cartridges or canisters (when buying new respirators replace all half-face with full-face) |
| Two (2) pr. | XXL Saranex coated Tyvek coveralls with attached hood, or equivalent |
| Two (2) pr. | XL unlined chemical resistant gloves – two pair every other type specific to branch operations |
| Two (2) pr. | XL chemical resistant rigid boots to be pulled over work shoes |
| Six (6) pr. | Inner gloves |
| Two (2) ea | Boot liners (small poly garbage can liners) |
| Two (2) ea | Hard hats/bump hats with attachable face shields |
| Two (2) pr. | Unvented (vapor proof) goggles |
| Four (4) pr. | Safety glasses |
| Two (2) rolls | Cloth or paper disposable coveralls |
| Four (4) ea | 2-3” duct tape |
| 500 ft | Traffic cones or stanchions with means to attach barrier tape |
| Two (2) ea | 1-2” rolls barrier tape |
| Two (2) ea | Min. 12’ x 20’ poly tarp |
| Six (6) ea | Air pump adaptable to pools or (hose to transfer from truck tires) |
| One (1) ea | 5-gal. empty pail with lid |
| Two (2) ea | 2-3 gal. pump hand sprayers |
| Five (5) gal. | Long handled, soft bristled scrub brushes |
| Two (2) gal. | Decon water |
| Two (2) qts. | Chlorine bleach |
| Three (3) ea | Non-phosphate detergent (Dawn or Tide) |
| Three (3) ea | Open head salvage drums |
| Two (2) ea | Poly salvage drum liners (pallet covers) |
| One (1) ea | Long handled poly bristled/poly or metal handled push brooms (one fine, one course bristled) |
| One (1) ea | Poly dust pan |
| 1,000 lb. | Poly scoop shovel and one steel spade with poly handle |
| Ten (10) lb. | Absorbent material (may be shrunk wrapped on a pallet next to spill kit box) |
| Five (5) gal. | Plug-n-dike |
| One (1) ea | Potable water |
| One (1) ea | First aid kit with CPR mouth protector |

**MAJOR SPILL KIT** items for strategically located branches and remotely located branches:

| | |
|---|---|
| Two (2) ea | Full-face respirators with all appropriate cartridges or canisters (when buying new respirators, replace half-face respirators) |
| One (1) box | Pesticide cartridges |
| One (1) box | Ammonia cartridges or canisters |
| Twelve (12) pr | XXL/XXXL Saranex coated Tyvek coveralls with attached hoods or equivalent |
| Twelve (12) pr | XL unlined chemical resistant gloves – Twelve pair every other type specific to area operations |
| Two (2) pr | XL rigid chemical resistant boots to be pulled over work shoe |
| Twelve (12) pr | Boot liners (small poly garbage can liners) |
| One (1) box | Latex glove liners (usually 100 individual per box) |
| Two (2) pr | Unvented (vapor proof) safety goggles |
| Two (2) pr | Safety glasses |
| Two (2) ea | Hard hats/bump hats with attachable face shields |
| Four (4) pr | cloth or paper disposable coveralls |
| Six (6) rolls | 2-3” duct tape |
| Four (4) ea | Traffic cones or stanchions with means to attach barrier tape |
| 500 ft | 1-2” rolls barrier/caution |
| Two (2) ea | Min. 12’ x 20’ poly tarp |
| Two (2) ea | Inflatable 48” swimming pools |
| One (1) ea | Air pump adaptable to pools or hose to transfer from truck tires |
| Six (6) ea | 5-gal. empty pails with lids |
| One (1) ea | 2-3 gal. pump hand sprayer |
| Two (2) ea | Long handled, soft bristled scrub brushes |
| Five (5) gal. | Decon. water |
| Two (2) gal. | Chlorine bleach |
| Two (2) qts. | Non-phosphate detergent (Dawn or Tide) |
| Six (6) ea | Open-head salvage drums |
| Ten (10) ea | heavy duty drum liners (pallet covers) |
| One (1) box | Approx. 25 large, heavy duty poly trash bags |
| Two (2) ea | Long handled poly bristled/poly or metal handled push brooms (one fine and one course-bristled) |
| One (1) ea | Poly dust pan |
| One (1) ea | Poly scoop shovel and one steel spade with poly handle |
| 1000 lbs. | Absorbent material (may be shrunk wrapped on a pallet next to spill kit box) |
| Ten (10) lbs. | Plug-n-dike |
| Five (5) gal. | Potable water |
| One (1) ea | First aid kit with CPR mouth protector |
| One (1) ea | Bag knife or comparable |
| Two (2) ea | Permanent markers |
| Two (2) ea | Flashlights with charged batteries |
| One (1) ea | Drum bung wrench |
| One (1) ea | Basic tool kit |
| One (1) ea | Saw and crow bar or sledge for breaking apart pallets and wooden handles |
| 100 lbs. | Hydrated lime |
| 100 lbs. | Soda ash |
| Ten (10) ea | Hazardous waste labels |
| Ten (10) ea | DOT hazard class placards |
| Twelve (12) | Copies of each page of the manual hazardous materials shipping document |
| One (1) ea | Traffic reflector kit |

OPTIONAL SPILL KIT ITEMS

| | |
|---|---|
| Four (4) ea | Traffic cones/stanchions |
| 500 ft. | 1-2 rolls barrier/caution tape or high visibility poly rope |
| Two (2) ea | Hand-held “STOP” signs |
| Five (5) gal. | Extra decon water |
| Two (2) ea | Extra 12’ x 20’poly tarps |
| One (1) ea | Extra 2-3 gal. hand pump sprayer |
| One (1) pr | Binoculars |
| One (1) set | Florescent vests for incident commander and key positions (4 to 8 vests) |
| One (1) ea | Portable generator |
| One (1) ea | Portable spot lights on stands |
| Two (20 MIN | CBS’s or radios |
| One (1) ea | Trash/diaphragm pump or transfer pump with hoses |
| One (1) ea | Mosquito repellent |
| One (1) pkg. | Toilet paper and paper towels |
| Five (5) gal. | Additional potable water or sports drinks |
| One (1) ea | Three gal. thermos jug and Styrofoam cups |
| 100 lbs. | Activated charcoal |
| One (1) ea | Trailer for storage and transport of spill kit |

## MAJOR SPILL KIT

**Minimum required for all trucks**:

| | |
|---|---|
| One (1) ea | Poly dust pan |
| One (1) ea | Hand brush or broom |
| One (1) ea | Spade shovel |
| One (1) ea | Ply scoop shovel |
| Two (2) ea | Heavy duty poly trash can liners |
| One (1) roll | Duct tape |

**Additional items** for trucks **hauling liquids** (packaged and bulk including NH3):

| | |
|---|---|
| 25lbs | Absorbent material (stored in plastic pails or plastic overpack bags) |
| Five (5) gal. | Emergency decon water |
| 2-3 lbs | Plug-n-dike |