(NAME OF ORGANIZATION)

HAZARDOUS MATERIALS EMERGENCY RESPONSE PLAN

(DATE)

_____

(Name of Authorizing Official)
(Title)

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It is the intent that this Plan be part of the formal training program in response, management and investigation of incidents involving hazardous substances. Even though it contains Standard Operating Procedures (SOPs) accepted by the (*INSERT NAME OF ORGANIZATION*), it is not intended to set a "standard of operations" for other organizations or agencies in the United States. Users outside of the (*INSERT NAME OF ORGANIZATION*) are directed to follow all system, agency / employer guidelines and all applicable local, state and federal regulations.

(*NAME OF ORGANIZATION*)
HAZARDOUS MATERIALS EMERGENCY RESPONSE PLAN

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INTRODUCTION

NOTE: The recommended practices and procedures outlined in this *Hazardous Materials Emergency Response Plan* DO NOT apply to situations where there is no potential safety and/or health hazard present and there is no risk of personal exposure to hazardous substances, since the requirements of OSHA's *Hazardous Waste Operations and Emergency Response Rule* (29 CFR 1910.120) are not applicable to these situations.

I.1: The (*Insert Name of Organization*) *Emergency Response Plan* (ERP) is designed to provide the user with guidelines for managing the following types of situations that involve the investigation of fires or explosions.

I.2: In order to protect both lives and property, and to ensure that emergencies are managed in a safe and effective manner, all (*Insert Name of Organization*) employees should be familiar with the specific or general duties assigned to the respective individual, position or department, and with the established lines of communication as outlined within the *Emergency Response Plan*.

I.3: The objectives of the (*Insert Name of Organization*) *Emergency Response Plan* are to:

- Prevent injuries to investigators and emergency response personnel.
- Minimize the impact of an incident upon personnel, property, equipment and the environment.
- Define investigator actions and responsibilities during a fire or explosion incident.
- Coordinate operations with local public safety organizations (i.e., police, fire, etc.)
- Ensure that appropriate records and documentation are maintained.
- Establish guidelines for compliance with applicable government regulations and voluntary consensus standards (e.g., NFPA 472, 921, 1033, 1500).

I.4: The (*Insert Name of Organization*) *Emergency Response Plan* has been developed to meet the emergency response and planning requirements of the following regulations:

- OSHA 29 CFR 1910.38 (a) - *Employee Emergency Action Plans*
- OSHA 29 CFR 1910.120 (q) - *Hazardous Waste Operations and Emergency Response*

I.5: Investigators routinely respond to the scenes of fires and explosions that occur at various residential, commercial, and industrial occupancies. Although most of these incidents do not involve hazardous materials or hazardous wastes, certain situations may pose potential safety and/or health hazards, or the potential for exposure to hazardous substances, thereby qualifying as hazardous materials incidents as defined by Occupational Safety and Health Administration (OSHA) regulations (29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response*).

I.6: As a result of state and federal regulations, investigators who participate in on-scene activities, must comply with all of the applicable HAZWOPER requirements commensurate with their level of participation (*e.g., First Responder Awareness, First Responder Operations, Hazardous Materials Technician, etc.*). Investigators involved in operations conducted at scenes where hazardous substances (i.e., hazardous materials and/or hazardous wastes) are present in violation of the OSHA standards are subject to citations for non-compliance.

I.7: The safety and health of investigators working at fire and explosion scenes where hazardous substances are involved can be threatened by a variety of physical, chemical, and toxicological hazards. The fire scene itself may include a number of physical hazards such as damaged structural members, broken glass, holes in floors, hanging light fixtures, exposed electrical wiring, and falling debris. Although some dangers are evident immediately, others may be deceiving, delaying their effects for several hours or days after fire suppression and investigative activities are completed.

I.8: Fire investigators have a duty to themselves and others who may be endangered at fire scenes to recognize potential safety and health hazards and exercise caution while conducting origin and cause investigations. Brief or extended exposure to hazardous materials by personnel without proper protective clothing and equipment can have

serious acute and chronic health consequences, depending on the type of chemical(s) encountered and the duration, concentration, and route(s) of exposure.

I.9: Fires and explosions typically generate a wide range of potentially flammable and toxic gases. Toxic hazards can include irritants, corrosives, water reactive chemicals, and asphyxiants that pose immediate or delayed adverse effects on the central nervous system, skin, and respiratory tract. Entering scenes that contain potentially hazardous atmospheres, or locations that have been declared hazardous materials or hazardous waste sites without the proper level of personal protective clothing and respiratory protection can result in serious adverse short and long-term health consequences, including death.

I.10: Potentially hazardous atmospheres should be tested using appropriate monitoring equipment to determine if such hazardous conditions exist before working in the area or introducing potential ignition sources such as electrical arcs from flashlights, radios, cameras, portable lighting equipment, generators, etc. The atmosphere should also be monitored periodically throughout the course of the investigation, since the atmosphere may become hazardous after the initial air sampling is performed and site entry is made.

I.11: Chemical hazards can take the form of solids, liquids, gases, or mists from chemicals ranging from ammonia to xylene and can include various common chemicals stored and used in most homes, businesses, commercial buildings, or industrial occupancies. Clues indicating the presence of flammable, toxic, or reactive materials often go unnoticed.

I.12: In fire situations, any number of these chemicals can become involved, presenting a number of flammability, toxicity, or reactivity hazards to investigators. In addition, it is not uncommon for oxygen-deficient atmospheres to be present within a structure that has sustained a fire or explosion.

I.13: Fire investigators are potentially threatened by a wide variety of common chemicals stored in residental and commercial occupancies. Although these materials are generally found in small quantities and, by themselves, present a low risk when properly used, in a fire situation, the synergistic effects can cause these materials to liberate toxic byproducts such as carbon monoxide, hydrogen chloride, nitrogen oxides, aldehydes, sulfur dioxide, and hydrogen cyanide. Some common household furnishings and carpeting can also liberate similar toxic gases when involved in a fire.

I.14: Investigators at the scene of a fire or explosion should be on constant alert for unsafe or hazardous conditions and should ensure that appropriate safety precautions are taken by all persons working at the scene. Investigators should keep in mind that the potential for serious injury exists at any time, and they should not become complacent or take unnecessary risks. The need for this awareness is especially important when the structural stability of the scene is unknown, or when the investigation requires that the investigator work above or below ground level or in confined spaces. The investigator should never enter a scene alone and should always coordinate his or her activities with the On-Scene Incident Commander so that the necessary personnel accountability and back-up procedures can be implemented.

I.15: Investigators should always wear proper safety equipment, including safety shoes or boots, gloves, safety helmet, respiratory protection and protective clothing, such as coveralls or turnout gear at all times. Where hazardous conditions exist, special precautions should be taken as necessary.

I.16: In certain situations, special equipment may be required to maintain the highest possible degree of safety. This equipment includes flashlights or portable lighting, safety glasses or goggles, rubber gloves, lifelines, ladders, specialized filter masks or respirators, positive pressure self-contained breathing apparatus (SCBA), and specialized chemical protective clothing, if necessary. Some of this equipment requires special training in its use and operation. ***Fire investigators should not attempt to use personal protective clothing or equipment unless they have received appropriate training***.

NOTE: Investigators should refer to Chapter 10 of NFPA 921, *Guide for Fire and Explosion Investigations*, for additional information concerning scene safety practices.

I.17: Certain elements are necessary to achieve the objective of becoming part of the solution. Some of these elements are pre-emergency planning, training, equipment, supplies, and the development of standard operating

procedures (SOPs). The purpose of this *Hazardous Materials Emergency Response Plan* is to provide personnel with standard operating procedures and responsibilities when conducting operations at incidents where hazardous materials incidents may be involved. The advantages of standard operating procedures include:

1. Improved coordination
2. Facilitates training
3. Ensures adequate protection of personnel
4. Provides consistency
5. Serves as reference guide
6. Reduces time in problem solving

I.18: Proper utilization of SOPs and COMMON SENSE can help prevent a hazardous material incident from becoming a hazardous materials emergency.

I.19: This **HAZARDOUS MATERIALS EMERGENCY RESPONSE PLAN** has been developed and implemented as the *Emergency Response Plan* for the (*Insert Name of Organization*), as mandated by the requirements of paragraph (q)(1), Title 29 Code of Federal Regulations (CFR) Part 1910, Section 1910.120.

I.20: For the purpose of this Plan, **hazardous material** means:

"A substance or material (i.e., solid, liquid or gas) that when released into the atmosphere or environment, is capable of creating harm to people, the environment and property."

I.21: In this Plan, an **incident** is an occurrence where a fire or explosion produces or causes hazardous conditions to people, property or the environment.

I.22: Similar to fire fighting activities, hazardous material incident management may require latitude in the decision-making process. This guide is not intended to inhibit that process, but to complement it. For safety, for compliance with the law, and for organizational purposes, personnel should attempt to meet as many tenets of this protocol as possible while working any hazardous material incident. **Life safety of all personnel is the # 1 priority**.

I.23: This Plan is available for review and copying by employees and their representatives, and will be reviewed and updated annually.

I.24: Changes to this document will be distributed as "page replacement" changes, along with a cover sheet for filing with the publication. Thus, as the document is updated, obsolete pages will be replaced with new pages, or new pages added. This guide will be reviewed and updated annually, or as recommended improvements or regulatory provisions dictate.

I.25: Please address any recommended changes or comments to:

(*INSERT CONTACT*): *Name*
Title
Street
City, State, Zip Code

NOTE: Organizations should also refer to the latest edition of *Standard on Fire Department Safety and Health Program* (NFPA 1500) for guidance concerning applicable OSHA requirements and in developing safety and health programs.

1. RESPONSIBILITY

1.1: The (*Insert Name of Organization*) is responsible for providing (*List specific services and responsibilities*) that are necessary to investigate fire and explosion incidents to determine their origin and cause, establish responsibility for the event, and to make recommendations to prevent similar events from reoccurring in the future.

1.2: The (*Insert Name of Organization*) shall provide technical expertise, assistance, and equipment at the incident and shall perform duties as directed by the Incident Commander (IC) pertaining to the investigation of the origin and cause of the incident.

1.3: The first few minutes after arrival of personnel to an incident involving a fire or an explosion are the most critical. Identification and stabilization of an incident are the primary goals of initial arriving fire department / hazardous materials response personnel, while investigators are responsible for determining the origin and cause of the incident and establishing responsibility for the event.

1.4: There is potential danger to personnel who are unprotected when they approach the scene to conduct investigations. Necessary steps to ensure adequate protection for personnel include the establishment of a "safe" perimeter, procedures for entering the incident site, air monitoring to determine if a hazardous atmosphere exists and selection of the proper level of personal protective clothing and equipment (PPE).

PRELIMINARY SCENE EXAMINATION STAGE:

1.5: Once an incident has been stabilized, and the condition of the atmosphere is determined to be safe through appropriate air monitoring, efforts may be directed toward entering the scene to determine the origin and cause of the event. In most situations, stabilization of the incident is most readily achieved by fire department / hazardous materials response team personnel prior to the arrival of investigators.

SALVAGE / OVERHAUL STAGE:

1.6: Salvage and overhaul is the final stage of the incident and the (*Insert Name of Organization*) will NOT generally participate in this stage **UNLESS** the scene is declared to be a crime scene and the entry of outside parties is restricted until investigators relinquish custody and control of the scene to the property owner.

1.7: In situations where the property owner cannot be identified within a reasonable time frame, assistance from the appropriate state or local agency (e.g., Police) should be requested by the Incident Commander (IC). Salavage and overhaul by fire department personnel shall only be performed when the preliminary scene examination has been completed, and investigators have determined that operations by personnel can be safely performed.

1.8: If the scene is determined to be too "hazardous" for personnel and equipment to safely enter, and (*Insert Name of Organization*) is unable to safely handle the situation, the Incident Commander (or senior ranking investigator) shall suspend on-scene operations, and consider delaying entry into the scene, or if time is not a factor, shall wait until there is no longer a potential safety and/or health hazard present and the atmosphere is considered "safe" to enter without the need for personal protective clothing and equipment.

1.9: In situations where hazardous materials / substances are involved, investigative personnel shall not directly contact cleanup/disposal agencies. The responsible party, in conjunction with fire department / hazardous materials response personnel, will make this contact. The responsible party is to be informed that he/she is financially responsible for the cleanup/disposal of incidents where hazardous materials are involved.

2. ACTIVATION

2.1: The response to a fire or an explosion incident where hazardous substances may be involved is made when the (*Insert Name of Organization*) is notified of an incident through (*Specify Method of Notification/Communication*) by (*Insert Name of Requesting Agency or Agencies*).

2.2: Initiation and reporting procedures are as prescribed in Section 13 of the *Hazardous Materials Emergency Response Plan*.

3. SCENE MANAGEMENT

3.1: The management of fire or explosion incidents involving hazardous substances requires an organizational structure which coordinates personnel, information and resources in a safe and effective manner. This is particularly critical with respect to the coordination of both investigators and other public safety response resources (i.e., fire department and law enforcement agencies). To enhance this coordination, it is critical that the incident command structure and terminology be consistent between all organizational levels.

3.2: Historical review of emergency response system failures reveals that many incidents are not handled effectively due to poor incident command, control and communications. The basic principles of emergency incident command are: (1) singular command; (2) objectives must be developed and prioritized; and (3) objectives must be communicated to those individuals expected to carry out the objectives.

3.3: Experience shows that organizations that handle the small, more routine-type incidents using a formal *Incident Command System* are more likely to function effectively when a major incident occurs. Similarly, the larger and more significant the emergency, the greater the need for an *Incident Command System*. The U.S. Occupational Safety and Health Administration (OSHA) requires that organizations which respond to emergency incidents that involve hazardous materials/substances adopt a locally recognized *Incident Command System* [(29 CFR 1910.120(q)(3)(i)].

3.4: The management of a hazardous materials incident is a partnership involving Federal, State, County/City and private industry. (*Insert Name of Organization*) main responsibility centers on conducting an inquiry into the circumstances surrounding the incident to determine the origin and cause and filing appropriate reports and documentation for the event. Proper scene management includes coordinating resources and ensuring that all on-scene activities are conducted in a safe and effective manner.

3.5: The (*Insert Name of Organization*) will support local and county government emergency services agencies and conduct its activities in accordance with all applicable federal, state and local state laws and plans required to safely and effectively investigate fires and explosions.

3.6: Scene management at hazardous material incidents is the key element and the most critically important function performed by personnel. The effective use of personnel and coordinated activities of other resources is paramount to the safe, successful and timely mitigation of these incidents.

3.7: The senior emergency response official that responds to an emergency shall become the individual in charge of a site-specific Incident Command System (ICS). All response personnel and their communications shall be coordinated and controlled through the individual in charge of the ICS assisted by the senior official present for the agencies/organizations at the scene. The "senior official" at an emergency response is the most senior official on the site who has the responsibility for controlling the operations at the scene (e.g., fire chief).

3.8: Note to (q)(3)(i).--The "senior official" at an incident involving hazardous materials is the most senior official on the site who has the responsibility for controlling the operations at the site. Initially it is the senior officer on the first-due piece of responding emergency apparatus to arrive on the incident scene. As more senior officers arrive (i.e.; battalion chief, fire chief, state law enforcement official, site coordinator, etc.) the position is passed up the line of authority that was previously established.

3.9: The individual in charge of the ICS shall identify, to the extent possible, all hazardous substances or conditions present and shall address as appropriate site analysis, use of engineering controls, maximum exposure limits and hazardous substance handling procedures.

3.10: Based on the hazardous substances and/or conditions present, the individual in charge of the ICS shall implement appropriate emergency operations, and assure that the appropriate personal protective equipment is worn for the hazards to be encountered. However, personal protective equipment shall meet, at a minimum, the criteria contained in 29 CFR 1910.156(e) when worn while performing fire fighting operations beyond the incipient stage for any incident or site.

3.11: Investigators working at the scene that may be exposed to hazardous substances presenting an inhalation hazard or potential inhalation hazard shall wear positive pressure self-contained breathing apparatus (SCBA) until

such time that the individual in charge of the ICS determines through the use of air monitoring that a decreased level of respiratory protection will not result in hazardous exposures to personnel.

3.12: The individual in charge of the ICS shall limit the number of personnel at the scene, in those areas of potential or actual exposure to incident or site hazards. However, operations in hazardous areas shall be performed using the buddy system in groups of two or more.

3.13: Back-up personnel shall stand by with equipment ready to provide assistance or rescue. Advance first aid support personnel, at a minimum, shall also stand by with medical equipment and transportation capability. OSHA requires a minimum number of persons to be present in certain emergency situations when an Immediately Dangerous to Life and Health (IDLH) atmosphere (or potential IDLH atmosphere) may be present before entry into hazardous areas can commence.

3.14: 29 CFR 1910.120 (q)(3)(v) requires that a minimum of four (4) persons be present during an emergency response to the release of hazardous substances. This is based on the agency's reference to the "buddy system" which means that at least two persons must enter the hazardous area and at least two additional persons must stand-by outside of the area with equipment ready to provide assistance or rescue in the event that something happens to the entry team. This does not necessarily mean that four investigators must be present at all scenes where hazardous materials may be present. However, the standard does require that at least four (4) individuals be present at the site before entry operations can begin. n most situations, the most practical means to satisfy this requirement is to coordinate on-scene activities with a Hazardous Materials Response Team (HMRT), provided one is available. If not, four (4) appropriately trained investigative personnel must be present to conduct incident operations, or operations cannot be conducted.

3.15: In many jurisdictions, a HMRT will either already be present at the scene or will be requested to respond to support on-scene operations if the presence of hazardous materials are suspected. A safe and effective operation will require a coordinated effort between all agencies present at the incident scene (e.g., fire department, HMRT, law enforcement, government officials, etc.).

3.16: The individual in charge of the ICS shall designate a safety official, who is knowledgeable in the operations being implemented at the site, with specific responsibility to identify and evaluate hazards and to provide direction with respect to the safety of operations for the emergency at hand.

3.17: When activities are judged by the safety official to be an *Immediately Dangerous to Life & Health* (IDLH) condition and/or to involve an imminent danger condition, the safety official shall have the authority to alter, suspend, or terminate those activities. The safety official shall immediately inform the individual in charge of the ICS of any actions needed to be taken to correct these hazards at the scene.

3.18: An IDLH atmosphere refers to an atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life, or would cause irreversible or delayed adverse health effects, or would interfere with an individual's ability to escape from a dangerous atmosphere. The lower the IDLH value, the more toxic the substance.

3.19: There are three general IDLH atmospheres: toxic, flammable and oxygen deficient. In the absence of an IDLH value for toxic atmospheres, personnel should consider using an estimated IDLH of ten-times the TLV/TWA. IDLH values for flammable atmospheres are 10 to 20% of the lower explosive limit (*depending upon the situation - confined space vs. open air*), while an IDLH oxygen deficient atmosphere is 19.5% oxygen or lower as determined by atmospheric monitoring.

NOTE: IDLH was not originally designed as an exposure level for evaluating protective actions. However, EPA has determined that using one-tenth (10%) of the IDLH value is an acceptable level of concern for evaluating hazardous materials release concentrations and protective action options (i.e., evacuation or protection-in-place).

3.20: After emergency operations are terminated, the individual in charge of the ICS shall implement appropriate decontamination procedures.

NOTE: Detailed information with respect to appropriate decontamination procedures is referenced in Appendix B of this *Hazardous Materials Emergency Response Plan*.

4. INCIDENT CLASSIFICATIONS

4.1: Fire investigators typically encounter materials at fire and explosion scenes that technically qualify as hazardous substances (i.e., hazardous materials and/or hazardous wastes) as defined by OSHA, and therefore, are subject to regulation. Situations classified as **emergency responses** by OSHA include:

- Releases that may cause high levels of exposure to toxic substances;
- Situations that are life or injury threatening;
- Incidents requiring evacuation of the affected area; and
- Releases that pose for *Immediately Dangerous to Life and Health* (IDLH) conditions, fire and explosion hazards [exceeds or has the potential to exceed 25% of the Lower Explosive Limit (LEL)], the release requires immediate attention because of danger, or presents an oxygen deficient condition.

4.2: For purposes of this Plan, an **"incident"** is defined as any abnormal situation or condition requiring rapid attention and support by trained personnel to avoid a potential danger which may result in, but not limited to:

- Releases with **high levels of exposure** to toxic or hazardous substances;
- **Life threatening situations** requiring immediate medical attention or evacuation for further medical treatment;
- Situations involving **serious physical injury**.
- Situations which may be **immediately dangerous to life and health (IDLH)**;
- Situations where **fires and explosions** have occurred or where **25% of the lower explosive limit (LEL) is exceeded**;
- An **oxygen deficient condition**.
- Possible **damage or harm to the environment**; or
- Possible **material, equipment or other asset loss or damage**.

4.3: There are three levels of potential emergencies defined within the (*Insert Name of Organization*) *Incident Classification System* that are based on the nature and severity of the problem, and the area potentially impacted. Initial classification of the incident is important because it determines:

- Which internal department/agency resources, as well as outside agencies, will be alerted and notified to respond to the scene.
- What predetermined duties and responsibilities will be performed by investigative personnel under the *Incident Command System* in effect at the scene.
- What role investigators will play in the *Incident Command System* and how they will interface with the public safety response agencies and mutual aid units.

The three levels of emergencies are:

- **Level One (Minor) Incident**: Minimal danger to life, property and the environment. The problem is limited to the immediate area. Public health, safety and the environment are not affected. The emergency requires a response from personnel outside the affected area and/or outside responders. At the minimum, a hot zone and a command post should be established for all Level I incidents. A hot zone is the area of maximum hazard and is restricted to personnel wearing the proper level of protection.

Examples of Level One incidents include:

- Incipient stage fires which can be controlled by portable fire extinguishers.

- Hazardous Materials Emergency Response for control and clean-up of a small spill (*i.e., incidental release*).

- Leaks of hazardous substances that will not produce an IDLH environment.

- **Level Two (Serious) Incident**: Moderate danger to life and property. The problem is currently limited to the immediate property, but does have the potential for either involving additional exposures or migrating off-site and affecting the public health, safety and the environment for a short period of time. The release of any quantity of a known solid or liquid toxic material in a critical public area, or the release of any quantity of an unknown solid, liquid, or gaseous toxic material. All gases other than natural gas will be considered toxic. A formal command post and a staging area should be established. Incident zones and their control must be established and maintained. Localized evacuation may be required. Outside agencies may need to be notified.

  Examples of Level Two incidents include:

  - Serious fires or explosions requiring the local fire department to respond or outside assistance from public safety / mutual aid emergency response agencies.

  - Large releases of hazardous materials (e.g., fertilizer / paint warehouses).

  - Incident involving a fatality or serious personal injury as a result of a fire or explosion.

- **Level Three (Major) Incident**: Significant danger to life, property, and the environment. The problem may go beyond the immediate area and could impact public health, safety and the environment or a large geographic area for an indefinite period of time. A Level III incident is often considered a local disaster. The incident has escalated beyond the capabilities of our local resources and jurisdiction. The incident may last for days and large scale evacuation may be necessary. Many outside sources may be needed to provide assistance and support. These sources might include: chemical manufacturers; Red Cross; Salvation Army; Coast Guard; Environmental Protection Agency; Federal Emergency Management Agency; Office of Emergency Services, etc.

  Examples of Level Three incidents include:

  - Major fires or explosions (e.g., multiple alarm assignments) requiring the assistance of local, state or federal agencies to mitigate.

  - Major release of hazardous materials which may require notification of the community to shelter-in-place or evacuate.

5. RESPONSE

LEVEL I INCIDENTS**:**

5.1: For suspected or known Level I incidents, investigators will respond to the scene as requested and as needed by on-scene personnel (e.g., Incident Commander).

5.2: The IC shall call for the Hazardous Materials Response Team (HMRT) whenever hazardous materials are involved and additional expertise or equipment is required to protect persons or the environment.

LEVEL II AND III INCIDENTS**:**

5.3: For Level II and III incidents, (*Insert Name of Organization*) will dispatch investigative personnel to the scene as directed by the Unit Supervisor in conjunction with the Incident Commander through normal communications channels.

5.4: A Hazardous Materials Response Team (HMRT) shall be notified to provide support anytime on-scene personnel determine that hazardous substances may be involved, if available. **Investigative personnel will not enter the scene if they do not possess adequate training, equipment or back-up personnel as required in accordance with 29 CFR 1910.120 (q)**.

6. FIRE / ARSON INVESTIGATION UNIT PERSONNEL

6.1: The Fire / Arson Investigation Unit is organized to perform the functions designated by the (*Insert Appropriate State and/or Local Legislative Statute / Ordinance, or Organization Charter*).

6.2: The Fire / Arson Investigation Unit is headquartered in the (*Insert Name of Department/Bureau/Organization*). It is comprised of specially trained, equipped and designated personnel who are available for specialized assignments with the unit (e.g., Bomb Squad, Hazardous Devices Disposal Units, Clandestine Drug Laboratory Seizure / Clean-up activities).

6.3: All members of the unit are have completed an appropriate hazardous materials training program to provide the following skills and knowledge:

1. An understanding of what hazardous materials are, and the risks associated with them in an incident.

2. An understanding of the potential outcomes associated with an emergency created when hazardous materials are present.

3. The ability to recognize the presence of hazardous materials in an emergency.

4. The ability to identify the hazardous materials, if possible.

5. An understanding of the role of the first responder awareness individual in the employer's emergency response plan including site security and control and the U.S.Department of Transportation's *Emergency Response Guidebook*.

5. The ability to realize the need for additional resources and to make appropriate notifications to the communication center.

6. Knowledge of the basic hazard and risk assessment techniques.

7. How to select and use proper specialized chemical personal protective equipment provided.

9. An understanding of basic hazardous materials terms.

10. How to perform basic and advanced control, containment and/or confinement operations within the capabilities of the resources and personal protective equipment available within their unit.

11. Understand and implement decontamination procedures.

12. An understanding of the relevant standard operating procedures and termination procedures.

13. How to implement the employer's emergency response plan.

14. The classification, identification and verification of known and unknown materials by using field survey instruments and equipment.

15. Being able to function within an assigned role in the Incident Command System.

16. Understanding basic chemical and toxicological terminology and behavior.

6.4 Unit annual refresher training also addresses the care, use and/or selection of personal protective clothing and equipment including totally encapsulating suits, air monitoring, the medical surveillance program, standard operating procedures, incident management guidelines, decontamination, and other appropriate subject areas.

6.5: Other specially trained, equipped and designated personnel, typically Hazardous Materials Response Team Members, will perform other related duties as necessary as assigned by the Incident Commander.

7. ON-SCENE OPERATIONS

NOTE: All on-scene operations will be conducted in accordance with the *Eight Step Incident Investigation Procedure*© located in Appendix C of this *Hazardous Materials Emergency Response Plan*. In addition, a summary of initial functions to be performed at incidents involving hazardous substances is also included in Appendix G.

7.1: The Incident Commander (IC) must take immediate steps to identify, assess and monitor any incident involving hazardous materials. The initial decisions can have a substantial effect on the outcome, but the assessment may often be made without full information. As new information becomes available, it must be evaluated.

7.2: The IC will relay information to their respective communications center about the hazardous material incident. This information will assist and expedite the alerting process for on-site mitigation activities. Notification of other appropriate city, county, state and federal agencies shall be made by the communications center.

7.3: A site-specific *Site Safety Plan* must be developed and implemented for each site where investigators may potentially be exposed to hazardous substances while conducting scene examinations (29 CFR 1910.120 (b)(4)). The purpose of the *Site Safety Plan* is to address the safety and health hazards that may exist at each phase of site operations and to identify procedures for the protection of personnel and the environment.

7.4: A *Site Safety Plan* shall be prepared and reviewed by qualified occupational health and safety professionals for each hazardous substance response action. The *Site Safety Plan* must address the safety requirements for hazardous activities, whether they are routine response activities or unexpected site emergencies. Before site operations commence, all safety aspects of the operations to be performed should be thoroughly examined, and the *Site Safety Plan* must be updated if new tasks or hazards are identified at the site. A sample *Site Safety Plan* is included as part of this *Hazardous Materials Emergency Response Plan* in Appendix D.

7.5: The materials involved must be identified so the associated hazards can be determined and proper control measures implemented. Without proper and prompt identification, accurate corrective actions cannot be implemented.

NOTE: All unidentified / unverifiedconditions at a fire or explosion scene should be considered dangerous unless they are proven safe through appropriate procedures. Personnel should never enter the potential hazard area until the risks are known. Fire / Arson Investigation Unit personnel should verify any identification or problem assessment conducted by other personnel prior to initiating any action(s).

7.6: When on-scene personnel are unable to identify any hazardous substances / conditions, or where the severity of the hazard cannot immediately be determined, or the proper course of action is not clear, the I.ncident Commander shall, without delay, seek technical assistance.

7.7: The senior ranking unit member on the scene shall determine the need for technical advisors and/or equipment. Requests for technical advisors or equipment should be made through the Incident Commander. If on-scene advice is required, the IC can request technical assistance. Technical assistance is available from:

1. Reference books.
2. Technical information specialists.
3. State Fire Marshals Office.
4. Bureau of Alcohol, Tobacco and Firearms (BATF).

5. Federal Bureau of Investigation (FBI).

7.8: As part of the on-scene assessment, investigators and the IC shall confer regularly, and always before initiating any control actions. Reference materials and other sources of information previously listed should be used to assist in determining risks of the substances, materials or conditions involved.

7.9: Control of activities within the safety perimeter shall be the responsibility of the Hazardous Materials Response Team Leader (or a qualified individual designated by the senior ranking officer on the scene) who has been properly trained and equipped to assume the responsibilities of the position.

7.10: Immediately after the preliminary size-up, monitoring should be instituted to determine the potential hazard(s). A qualified individual should be assigned to conduct a survey around the perimeter of the incident. Depending on the size of the incident, more than one person may be needed. Appropriate air monitoring will be conducted around the complete perimeter, especially downhill and downwind, as necessary.

7.11: The entry team shall be equipped with positive-pressure self-contained breathing apparatus, appropriate protective clothing, suitable monitoring equipment, and a portable radio (or other means of communication).

7.12: Monitoring shall be performed in accordance with established policies and procedures where there may be a question of personnel exposure to hazardous concentrations of hazardous substances in order to ensure proper selection of engineering controls, work practices and personal protective equipment so that investigators are not exposed to levels which exceed permissible exposure limits or published exposure levels for hazardous substances.

7.13: Air monitoring shall be used to identify and quantify airborne levels of hazardous substances and safety and health hazards in order to determine the appropriate level of personal protection needed on site.

7.14: Upon initial entry, representative air monitoring shall be conducted to identify any IDLH condition, exposure over permissible exposure limits or published exposure levels, exposure over a radioactive material's dose limits or other dangerous condition such as the presence of flammable atmospheres or oxygen-deficient environments.

7.15: Periodic monitoring shall be conducted when the possibility of an IDLH condition or flammable atmosphere has developed or when there is an indication that exposures may have risen over permissible exposure limits or published exposure levels since prior monitoring. Situations where it shall be considered whether the possibility that exposures have risen are as follows:

1. When work begins on a different portion of the site.

2. When contaminants other than those previously identified are encountered.

7.16: Initial monitoring efforts should be directed towards determining if IDLH concentrations are present. Decisions regarding protective clothing recommendations, establishing control zones, and evaluating any related public protective actions should be based upon the following parameters:

a) *Flammability* - if dealing with a confined space or indoor release, the IDLH/action level is 10% of the lower explosive limit (LEL). If dealing with an open-air release, the initial action level is 20% of the LEL.

b) *Oxygen* - an IDLH oxygen deficient atmosphere is 19.5% oxygen or lower, while an oxygen-enriched atmosphere contains 23.5% oxygen or higher. In evaluating an oxygen deficient atmosphere, consider that the level of available oxygen may be influenced by contaminants which are present.

c) *Toxicity* - unless a published action level or similar guideline (*e.g., Emergency Response Planning Guideline - ERPG*) is available, the STEL or IDLH values should initially be used. If there is no published IDLH value, emergency response personnel may consider using an estimated IDLH of ten-times the TLV/TWA.

d) *Radioactivity* - any positive reading above background level would confirm the existence of a radiation hazard, and should be used as the basis for initial actions.

7.17: The primary objective of using these various exposure guidelines is to minimize the potential for exposure by investigators. One method for understanding these exposure guidelines and applying them at a fire or explosion scene is the concept of **Safe**, **Unsafe** and **Dangerous**. Understanding this system will assist investigators in establishing control zones, selecting respiratory and chemical protection levels. Investigators should remember that it is virtually impossible to quantify an atmosphere and determine the type of atmosphere present without the use of monitoring instruments. Originally developed by Michael Callan (*retired Captain of the Wallingford, Connecticut Fire Department*), there are three basic atmospheres at an incident involving hazardous materials:

- **Safe atmosphere** - no harmful hazmat effects exist, which allows personnel to handle routine emergencies without specialized personal protective equipment (PPE). All of these exposure guidelines have one thing in common - remain below these values and the exposure is considered safe to the average healthy adult by all information which is known by today's health and safety professionals. However, recognize that these are dynamic values and have a tendency to be lowered over time as additional toxicological research and studies are completed (e.g., benzene). In addition, exposure to multiple chemicals may have additive or synergistic effects. If the chemical concentration exceeds any of these three TLV exposure values, one should assume that you are now in an unsafe condition. Stay exposed long enough and some form of harmful effects may occur

- **Unsafe atmosphere** - once a hazmat is released from its container, an unsafe condition or atmosphere exists. If one is exposed to the material long enough, some form of either acute or chronic injury will often occur. A general rule for investigators should be that an unsafe atmosphere exists at all fire and explosion scenes and some form of PPE is required. Prolonged exposures at high concentrations can lead to injury; however, acute injuries may not be lethal (e.g., headaches, nausea, irritation to the eyes, nose or throat). Unsafe atmospheres do not become seriously dangerous unless the exposure continues or the concentration of contaminants rises. The unsafe atmosphere is an area where some investigators may ignore the signs and symptoms of over-exposure. When dealing with a potential inhalation hazard, personnel must use positive pressure self-contained breathing apparatus (SCBA) until the Incident Commander determines (through the use of air monitoring) that a decreased level of respiratory protection will not result in a hazardous exposure

- **Dangerous atmosphere** - these are environments where serious irreversible injury or death may occur. When concentrations continue to increase above unsafe levels, there is a high potential for life-threatening injuries or death to occur. This concentration level is the IDLH. There are three general IDLH atmospheres: toxic, flammable and oxygen deficient. As previously noted, in the absence of an IDLH value for toxic atmospheres, investigators may consider using an estimated IDLH of ten-times the Threshold Limit Value (TLV) / Time-Weighed Average (TWA).

7.18: IDLH values for flammable atmospheres are 10 to 20% of the lower explosive limit (depending upon the situation - confined space vs. open air), while an IDLH oxygen deficient atmosphere is 19.5% oxygen or lower. An oxygen-enriched atmosphere contains 23.5% oxygen or higher. While these atmospheres can cause harm in various ways, the degree of harm is similar.

7.19: Investigators may not always have immediate access to monitoring instruments. Therefore, the following list contains some of the physical indicators of likely IDLH conditions:

Outside or Open Air Environment

- Visible vapor cloud - Large vapor clouds obviously indicate large concentrations of contaminants. Avoid entering a vapor cloud at all costs.

- Release from a bulk container or pressure vessel - Bulk containers can release large quantities of liquid and gas products. Bulk pressurized containers, such as horizontal tanks and spheres containing liquefied gases and cryogenic liquids, will pose the greatest hazards because of their tremendous liquid to vapor expansion ratios.

- Large liquid leaks - All liquids give off vapors when released. High vapor pressure liquids, such as many solvents and fuming corrosives, and pooled liquefied gases, such as chlorine and anhydrous ammonia, are particularly dangerous.

Inside or Limited Air Environment

- Below grade rescues or releases - small amounts of heavier than air vapors can accumulate in low lying areas. Such areas should be avoided unless personnel are properly protected.

- Confined spaces - any enclosed area where there is poor ventilation can result in either an oxygen deficient, toxic or flammable atmosphere, depending upon the hazmats involved. **Sixty percent of all fatalities at confined space emergencies are personnel who are acting in a rescuer capacity**.

- Artificial or Natural Barriers - any time vapors can be trapped, they will accumulate and potentially increase in concentration. Tank dikes, highway sound barriers and high vertical walls are potential areas where heavier than air toxic or flammable vapors can accumulate.

Biological Indicators (or using your common sense!)

- Dead birds, discolored foliage, sick animals or even humans are a pretty good indicator that a chemical release may have occurred.

- Hazmats with a potential for quick and rapid harm, such as poisonous gases, explosives, some oxidizers and materials with very low IDLH values, should dictate the use of extreme caution.

- Physical senses and "street smarts" - Be aware of strong odors and other sensory warnings. Likewise, you don't have to be a chemist to look at a situation and determine that something is wrong. Don't underestimate your "sixth sense" - if the situation doesn't look or feel right, it probably isn't.

7.20: Protection of personnel at an incident is paramount. Exposure time of all personnel to hazardous conditions shall be kept to a minimum, even when personnel are wearing the proper level of personal protective clothing.

7.21: All on-scene investigative personnel shall don appropriate personal protective clothing and equipment and take all necessary steps to avoid contamination of themselves, others, property, and the environment. Appropriate protective equipment may include full turnout gear (coat, pants, boots, gloves and helmet) and positive pressure breathing apparatus, when appropriate. The arms, legs, waist and neck areas should be sealed with duct tape. As duty uniform pants do not have a vapor barrier, they do not offer adequate protection at hazardous materials incidents. All other response personnel should remain upwind from the incident site, unless properly protected and performing a necessary function.

7.22: The IC shall take necessary precautions in not exposing response personnel or the public to a potentially hazardous situation. Decisions concerning the incident should be made with the following criteria in mind:

1. Safety of emergency response personnel and the public:
   a. Fatalities.
   b. Injuries.
2. Property damage.
3. Critical system disruption (public utilities, transportation).
4. Environmental damage.
5. Legal implications.
6. Traffic control.

7.23: Operations at incidents where hazardous materials / substances are involved should be conducted from an upwind location if the incident involves fire or material subject to wind movement. Personnel should keep out of smoke, fumes or dust.

7.24: If serious injury has occurred demanding more than first aid measures, the patient should be transported immediately to the nearest hospital for medical attention. Medical and ambulance personnel and the receiving hospital must be advised of any possible contamination and/or decontamination solutions and procedures. Persons who may have had contact with the materials should be isolated for examination.

7.25: Incident control zones shall be established to prevent unauthorized persons from entering the area. A prompt evacuation of the threatened area using police and/or other assistance may be required. Protect the public by utilizing the recommended distances in the **North American Emergency Response Guidebook (ERG)** to isolate and/or evacuate people from spill areas. Keep the public as far back from the incident as possible. Prevent souvenir hunting and the handling of debris.

7.26: Ignition sources should be eliminated whenever possible at incidents involving releases, or potential releases of flammable materials. Whenever possible, electronic devices used within the hot zone should be certified as intrinsically safe by recognized organizations. Communication devices used within totally encapsulated protective suits do not need to comply with the above as long as the suit remains pressurized.

7.27: Do not eat food, drink water, or smoke since these actions increase the possibility of hand-to-mouth transfer in all contaminated areas. Segregate clothing and tools used at the incident until they can be checked for contamination.

7.28: Avoid committing personnel and equipment prematurely or "experimenting" with techniques and tactics. Many times it is necessary to evacuate and wait for special equipment or expert help.

7.29: In addition to specific actions, common sense rules should be observed at the scene of hazardous materials incidents, including:

- Minimize the number of personnel operating in the contaminated area.
- Avoid contact with all contaminants, contaminated surfaces, or suspected contaminated surfaces.
- Avoid walking through any suspected releases or placing equipment on contaminated surfaces.
- Advise all entry personnel of all site control policies including entry points, decon layout, procedures and working times.
- Always have an escape route.
- Ensure that everyone knows the emergency evacuation signals.
- Ensure that all tasks and responsibilities are identified before attempting entry. If necessary, practice unfamiliar operations prior to entry.
- Use the buddy system for all entry operations.
- Always ensure that properly equipped back-up crews are in place.
- Maintain radio communications between entry, back-up crews and the Safety Officer (whenever possible).
- Prohibit drinking, smoking and any other practices
- Follow decontamination and personal cleanliness practices before eating, drinking, or smoking after leaving the contaminated area.

8. COMMAND POST (C.P.)

8.1: The Incident Commander (IC) should promptly establish a command post. Failure to do so will lead to disorganization, which may cause important factors to be overlooked.

8.2: All persons and agencies requested to assist in the investigative effort will be directed to the Command Post for instructions, directions, assignments and incident information.

8.3: The location of the Command Post should be upwind a safe distance back from the scene and in the cold zone. The cold zone is the unrestricted area beyond the boundaries of the incident. If a Command Post is established, all on-scene personnel shall be notified immediately of the location and proper entry routes.

8.4: Staffing the Command Post is vitally important. In many cases, persons without uniform rank or persons from other departments may be assigned responsibilities.

8.5: A Public Information Officer (PIO) should be appointed to coordinate all information given to the media and to keep them informed, thus assuring that they do not disrupt the decision makers in the Command Post When the PIO is someone other than the IC, all information released should be cleared through the IC.

8.6: The PIO should seek the assistance and cooperation of the news media in evacuation operations (if required), in keeping spectators away, and in reporting closed highways or streets and the rerouted traffic patterns. Reports to the media must be correct and complete so that overly sensational material is not disseminated.

8.7: The IC assumes the primary function of on-scene management and coordination where threat to life and property are concerned. In assumption of this role, the IC is responsible for controlling and coordinating all operations related to the incident. All necessary personnel and equipment available locally, and through mutual aid, will support the assigned IC.

8.8: Command of the hot zone shall stay with the designated Hazardous Materials Response Team Leader or IC throughout the incident, unless he/she is relieved or command is transferred.

9. STAGING AREA/RESOURCE POOL

9.1: For Level II and III incidents, a staging area for personnel, vehicles and equipment should be established at a safe location where personnel and equipment can be assembled. This area should not be too close to the scene in case the situation unexpectedly increases in intensity. All units dispatched to the incident should be directed to report to the staging area. Responding units should be advised of the staging area location and the appropriate entry route.

9.2: Equipment and personnel already on scene should be moved to the staging area, if not already committed, needed or contaminated.

9.3: The staging area also serves as a rally point for aid coming into an incident site for post disaster support and recovery activities. During this phase of the incident, the staging area may be used as the base for coordinating localized emergency operations.

10. HAZARDOUS MATERIALS INCIDENT CONTROL ZONES

10.1: The purpose of implementing hazardous material incident control zones is to: secure a scene; establish perimeters; maintain safe and efficient control over operating personnel; and to prevent people, vehicles, and resource equipment from entering a threatening situation.

10.2: A hazardous material incident scene may be divided into three separate zones: HOT, WARM and COLD (safe). The hot zone denotes the area of maximum hazard, the warm zone surrounds and includes the hot zone, and the cold zone is the unrestricted area beyond the boundaries of the warm zone.

10.3: The size and shape of the control zones are influenced by a wide range of variables: physical and chemical properties; quantities of the hazardous material; the size, shape and condition of the container; the dispersion patterns of the material; existing and anticipated weather and wind conditions; and the geographic features surrounding the incident.
Incident control zones should be established by the IC as soon as possible, using all available technical information (guides and reference manuals) as well as advice from the Hazardous Materials Response Team.

10.4: Minor incidents may only require a small hot zone with traffic cones and officers or firefighters maintaining security. However, if conditions change, the IC must be prepared to establish hot and warm zones with increased staffing. The influence of natural factors such as weather and geography will often result in irregular shaped zones.

10.5: Control zones can provide an organized system that will assist the IC in properly terminating hazardous materials incidents while maximizing protection of emergency response personnel and civilians. Control zones can be established for toxic materials using the following guideline:

- *Hot Zone* - monitoring readings above IDLH exposure values.
- *Warm Zone* - monitoring readings equal to or greater than TLV/TWA or PEL exposure values.
- *Cold Zone* - monitoring readings less than TLV/TWA or PEL exposure values.

10.6: When evaluating the establishment of control zones at hazardous materials incidents, the various TLV and the IDLH values are generally the most informative. **REMEMBER - THE LOWER THE REPORTED CONCENTRATION, THE MORE TOXIC THE MATERIAL.**

HOT ZONE:

10.7: The hot zone is the area of maximum hazard and should be restricted to essential personnel wearing the proper protective clothing and having a specific activity. Access to the hot zone must be controlled by the department, with entry-exit restricted to one location. Personnel or teams entering the hot zone should have a portable radio.

10.8: Only authorized essential personnel that are directly involved in incident investigation activities shall be permitted inside the hot zone.

10.9: A minimum number of personnel, as needed, but not less than two shall make up the hot zone entry team.

10.10: A decontamination line separates the hot zone from the warm zone. The line is the inner perimeter of the warm zone. Ideally, the decontamination line should be identified using FIRE LINE, POLICE LINE - DO NOT CROSS or "Hazardous Materials-Do Not Enter" tape. Other available devices such as traffic cones or natural or man-made barricades (ditches, roads, fences, etc.) may also be used. The decontamination line should be easily recognized and strictly enforced.

10.11: A decontamination area may need to be established between the hot and warm zone. The extent of decontamination will be determined by the products involved and the amount of exposure. All personnel exiting the

hot zone must be properly decontaminated, and when necessary, leave their protective clothing in that area. All equipment being removed from the hot zone should be decontaminated, or packaged and properly disposed of. Disposal of equipment should be coordinated with the Incident Commander.

10.12: Due to inclement weather or other pertinent factors, decontamination at the scene may not be possible. In this situation, the nearest suitable designated structure may be used as the decontamination station for personnel and equipment.

10.13: **Non-department/agency personnel:** Certain hazardous materials incidents may require use of technical personnel, manufacturer's representatives, shipper or carrier experts, etc., to evaluate hazards and/or perform specific functions inside the Hot Zone. Such operations will only be conducted with the approval of the Incident Commander, and will be under the direct supervision of the Hazardous Materials Response Team Leader.

10.14: In most situations there are never enough Hazardous Materials Response Team members to accomplish all the tasks needed to be completed. A successful operation is contingent on the timely rotation of team members from one activity to another, in addition to using outside manpower to fill in at certain positions.

WARM ZONE:

10.15: The warm zone surrounds the hot zone and is also a restricted area. The level of personal protection required in the warm zone will usually be less than that in the hot zone.

10.16: Within this warm zone, relief, support and security personnel for those working in the hot zone are assembled, and all unauthorized personnel are withdrawn. Only essential personnel should be in this area and as in the hot zone, entry into the warm zone should be restricted to just one location.

10.17: The outer perimeter of the warm zone should be appropriately marked. Ropes and/or traffic cones may be used, but are not as effective as the warning tape.

10.18: A staging area should be established and located out of any potential harmful area.

COLD ZONE:

10.19: The cold zone is the unrestricted area beyond the outer perimeter of the warm zone. Although the cold zone is considered safe, and the movement of persons is considered unrestricted, with many incidents, it is prudent to keep the area restricted to emergency service personnel, and to keep the public several hundred feet beyond the outer perimeter of the warm zone.

10.20: An access route shall be clearly defined and kept open for the removal of injured civilians or personnel. This route will be used for emergency evacuation in the event the incident becomes uncontrollable.

SUPPORT PERSONNEL:

10.21: Due to the complexity of situations involving hazardous materials, specialized job functions must be assigned to insure the safety of all personnel operating at the scene.

Safety Officer:

10.22: The individual in charge of the ICS shall designate a safety official, who is knowledgeable in the operations being implemented at the emergency response site, with specific responsibility to identify and evaluate hazards and to provide direction with respect to the safety of operations for the emergency at hand.

10.23: When activities are judged by the safety official to be an IDLH condition and/or to involve an imminent danger condition, the safety official shall have the authority to alter, suspend, or terminate those activities. The safety official shall immediately inform the individual in charge of the ICS of any actions needed to be taken to correct these hazards at an emergency scene.

10.24: A Safety Officer should assist in establishing incident zones and control personnel entering the hot zone to ensure that everyone is properly protected. The Safety Officer should also establish the decontamination area and be familiar with the various levels of protective clothing available and medical implications of the incident. A member of the Hazardous Materials Response Team or a qualified fire department officer would normally assume the role of the Safety Officer.

10.25: The Safety Officer should establish and maintain a log including but not limited to: times of significant occurrences within the hot zone; products involved; names of personnel entering the hot zone; clocking time in and out; protective equipment worn by personnel entering the hot zone; and functions of personnel entering the hot zone.

10.26: The log will contain essential information should any exposed persons develop health problems in the future. The Safety Officer must be alert to any signs or symptoms of exposure. Medical examinations must be ordered if acute exposure is known or suspected.

10.27: Remember that hot and warm zones should have only one entry point. The Safety Officer must insure that all personnel and equipment exiting the hot zone are decontaminated. To facilitate decontamination, for each two persons entering the hot zone, at least one person should be assigned to the decontamination team.

10.28: Some type of emergency recall signal device, such as a hand held airhorn or voice amplifier, should be provided to the Safety Officer to immediately notify personnel in the hot zone to withdraw.

10.29: Persons entering the hot zone should be given a number that is easily spotted on their protective clothing to avoid confusion with directions from the perimeter. All withdrawal should take place through the decontamination area.

10.30: The Safety Officer will correct unsafe acts or conditions through the chain of command, or immediately when immediate action is required.

10.31: The Safety Officer should ensure that all other elements of safety are in place and that emergency medical services with transport capabilities are available.

Safety Team:

10.32: A Safety Team must be provided as a rescue or backup team for personnel working in the hot zone. The Safety Team shall be protected at the same level of protection as the team(s) working in the hot zone. Line of sight contact among personnel operating in the hot zone must be maintained. The Safety Team must also visually monitor operating personnel within the hot zone.

Site Security:

10.33: Personnel should be assigned security responsibilities to maintain the integrity of the hot zone. The primary function is to keep all unauthorized persons from entering the hot zone. Security personnel should be firefighters, but occasions may arise when it is prudent to have law enforcement officers perform security functions for the hot zone, but only if they can be properly protected.

10.34: Security personnel and the Safety Officer for the hot zone must remain out of the hot zone, and be provided with the proper level of protective clothing for the warm zone. Security personnel for the warm zone, preferably police, should be strategically positioned outside the outer perimeter of that zone. Their primary functions are to prevent unauthorized persons from entering, and to direct traffic.

Emergency Medical Services (EMS) Personnel:

10.35: OSHA 29 CFR 1910.120 (q)(3)(vi) requires that *"Advanced first aid support personnel, as a minimum, shall stand-by with medical equipment and a transportation capability at hazmat emergencies."* The level of emergency medical support may be influenced by the nature of the incident, risks involved, tasks to be performed, and the

intensity and/or duration of the tasks. Informal interpretations by OSHA have indicated that the following factors will be considered in determining whether a facility is in compliance with this requirement:

- Advanced first aid personnel are considered as individuals who have been trained to the Red Cross Advanced First Aid level or higher (e.g., First Responder, EMT, etc.), and are capable of providing the basic "ABCs" of medical care.

- Medical equipment is not required to be on-scene, but must be available for immediate response. As a general rule, medical treatment should be provided within 3 to 4 minutes of the accident, while a transportation capability should be on-site in approximately 15 to 20 minutes.

NOTE: Emergency medical support requirements for incidents involving hazardous materials should be outlined in the *Site Safety Plan*, as required by 29 CFR 1910.120. A generic *Site Safety Plan* is included as Appendix E of this Plan.

10.36: Emergency medical treatment personnel, preferably advanced life support personnel, are responsible for the care of rescued or injured persons. They should be familiar with medical procedures that are specific to the incident.

10.37: All EMS personnel on the scene should be aware of any necessary decontamination procedures. If any contaminated persons require immediate transportation to a hospital, the ambulance personnel and receiving hospital must be advised of the decontamination solutions and procedures. This information is available from container labels, reference books, or the Poison Control Center. For this reason, a well prepared and practiced communication system must be maintained with area hospitals.

10.38: Due to the nature of their assignment, Fire / Arson Investigation Unit personnel that conduct activitie in contaminated areas at scenes that have been designated as “hazardous materials” incidents or “hazardous waste” sites must participate in Medical Surveillance Program. Medical examinations and consultations shall be made available by the employer to each individual under the following guidelines:

1. As soon as possible upon notification by an employee that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards, or that the employee has been injured or exposed above the permissible exposure limits or published exposure levels in an emergency situation.

2. For employees who may have been injured, received a health impairment, developed signs or symptoms which may have resulted from exposure to hazardous substances resulting from an emergency incident, or exposed during an emergency incident to hazardous substances at concentrations above the permissible exposure limits or the published exposure levels without the necessary personal protective equipment being used:

    a. As soon as possible following the emergency incident or development of signs or symptoms;

    b. At additional times, if the examining physician determines that follow-up examinations or consultations are medically necessary.

10.39: Medical monitoring may be defined as *"an on-going, systematic evaluation of individuals at risk of suffering adverse effects of exposure to temperature extremes (i.e., heat or cold), stress, or hazardous materials as a result of working at a hazardous materials incident."*

The objectives of medical monitoring are to: (1) obtain baseline vital signs; (2) identify and preclude from participation individuals who are at increased risk to sustain either injury or illness, and/or who may increase the risks to others; and (3) facilitate the early recognition and treatment of personnel with adverse physiological and/or emotional responses.

10.40: Pre- and post-entry medical monitoring should be required at virtually every incident where hazardous substances are involved. Medical monitoring provides baseline vital signs of all entry personnel, and identifies,

evaluates and eliminates those individuals who are suffering from the effects of temperature extremes (i.e., heat or cold) or hazmat exposure. Medical monitoring is to be performed by a medically trained individual approved by the Safety Officer. This may include a designated and qualified HMRT member or outside EMS personnel called in to provide medical monitoring and EMS support.

Medical Monitoring Exam:

Components of the pre-entry exam should include the following:

- Vital signs, including blood pressure, pulse, and respiratory rate.
- Skin evaluation, with an emphasis on rashes, lesions and open sores or wounds.
- Mental status (alert and oriented to time, location and person).
- Recent medical history, including medications, alcohol consumption, any new medical treatment or diagnosis within the last 2 weeks, and symptoms of fever, nausea, diarrhea, vomiting or coughing within the past 72 hours.

Components of the post-entry exam should include the following:

- Any signs or symptoms of chemical exposures, heat stress or cardiovascular collapse.
- Vital signs, including blood pressure, pulse, and respiratory rate.
- Skin evaluation, with an emphasis on rashes, lesions and open sores or wounds.
- Mental status (alert and oriented to time, location and person).
- Hydration - provide plenty of liquids.

10.41: Some hazardous materials response teams also perform additional medical monitoring checks. These organizations may also require that an advanced life support (ALS / paramedic) unit provide stand-by EMS support. Additional medical monitoring checks may include the following:

- Body temperature - critical to watch for rapidly rising body temperature in the case of impending heat stroke.
- Eye movement.
- Body weight - a weight loss of six (6) or more pounds can indicate that an individual is a possible candidate for dehydration complications.
- Lung sounds, including wheezing, unequal breath sounds, etc.
- Ten (10) second EKG rhythm strip.
- Prehydration with 8 to 16 ounces of fluids.

10.42: Medical evaluators should recognize that vital signs may be elevated as a result of stress, excitement, environmental conditions, the type of operation, and the level of risk.

Medical Monitoring Exclusion Guidelines:

10.43: These guidelines are intended to assist both the Incident / Scene Commander, Safety Officer, and medical personnel in evaluating the ability of emergency response personnel to participate in entry operations. Medical evaluators must: (1) know and understand the monitoring elements and their ranges; (2) be trained to properly use the appropriate medical equipment; and (3) be trained to identify the signs and symptoms of fatigue, heat stress or any medical condition that may impair a responder's actions and body conditions.

NOTE: The following exclusion criteria are suggested guidelines and may be modified based upon the individual involved and the tasks being performed; however, they should not supersede any existing criteria which may be established by local medical control authorities.

1) Entry / re-entry should be denied if any of the following criteria are met:

CRITERIA	GUIDELINES
Blood Pressure	BP exceeds 100 mm Hg diastolic or below 60 mm Hg diastolic.

Pulse	Any irregular rhythm not previously detected or a maximum heart rate not to exceed 100 beats per minute (>100).
Respirations	Respiratory rate is greater than 24 per minute.
Mental Status	Altered mental status (e.g., slurred speech, clumsiness, weakness, acts impaired with or without alcohol).
Other Criteria, including: Skin Medical History	 Open sores, large skin rashes or significant sunburn. Recent onset of heart or lung problems, hypertension, diabetes, etc. Experienced nausea and vomiting, diarrhea, fever or heat exhaustion within the last 72 hours. Use of prescription medication and over-the-counter medicines (e.g., decongestants, antihistamines, etc.) must be cleared through local medical control. Heavy alcohol consumption within the previous 24 hours or any alcohol within the past 2 hours.

10.44: Post-entry medical monitoring is performed following decontamination to determine if the responder has suffered any immediate effects from heat stress or a chemical exposure, and to determine the individual's health status for future assignment during or after the incident. While at rest, a person's vital signs should be monitored approximately every ten (10) minutes until a level of stability is reached. If vital signs do not return to normal, it may be necessary to transport the individual to a medical facility. Medical personnel should be consulted for direction and recommendations, as necessary.

11. PROTECTIVE CLOTHING

11.1: The need for proper protective clothing and equipment (PPE) in a hostile environment is critical. Unfortunately, there is no one type of PPE that satisfies personal protection needs under all conditions. Hazardous materials can enter the body by inhalation, absorption or ingestion. Positive pressure self-contained breathing apparatus can protect the lungs, gastrointestinal tract and eyes against airborne contaminants. Chemical resistant clothing can protect the skin and body systems (blood, nervous system, etc.) from contact with toxic chemicals. Good personal hygiene limits or prevents ingestion of released substances. This includes proper decontamination and strict enforcement of the "no smoking, no eating" rule around hazardous materials.

11.2: The U.S. Environmental Protection Agency (EPA) has defined the following four levels of protective clothing for protection against contact with known or anticipated chemical hazards:

1. LEVEL A ENCAPSULATING CLOTHING INCLUDES:

    a. Positive pressure self-contained breathing apparatus.
    b. Encapsulating chemical resistant suit.
    c. Chemical resistant outer gloves
    d. Chemical resistant inner gloves (optional).
    e. Chemical resistant boots.

2. LEVEL B NON-ENCAPSULATING CLOTHING INCLUDES:

    a. Positive pressure self-contained breathing apparatus.
    b. Chemical resistant clothing, a hooded one or two piece chemical resistant splash suit which may be of the disposable type.
    c. Chemical resistant outer gloves.
    d. Chemical resistant inner gloves (optional).
    e. Chemical resistant boots.

3. LEVEL C NON-ENCAPSULATING CLOTHING INCLUDES:

    a. Full-face cartridge respirator.
    b. Chemical resistant clothing, a hooded one or two piece chemical resistant splash suit which may be of the disposable type.
    c. Chemical resistant outer gloves.
    d. Chemical resistant inner gloves (optional).
    e. Chemical resistant boots.

    NOTE: Level C offers the same level of skin protection as Level B, but the respiratory protection is less.

4. LEVEL D-WORK CLOTHES (STRUCTURAL FIRE FIGHTING CLOTHING) INCLUDES:

    a. Positive pressure self-contained breathing apparatus.
    b. Turn-out coat and pants.
    c. Helmet.
    d. Boots.
    e. Gloves.

NOTE: Structural fire fighting clothing is **NOT** designed to provide the wearer with any substantial chemical protection.

11.3: In assessing potential hazards, such factors as the physical state of the material (solid, liquid or gas), the degree of exposure (concentrations or amounts), known routes of entry into the body, levels of toxicity, and field conditions must be considered. Once the hazard has been determined, it is relatively easy to select the proper level of protective clothing and equipment that is necessary.

11.4: All personnel on the scene must remain alert for individuals in distress while in protective clothing, indicated by **both arms raised directly above the head**.

11.5: Full protective structural fire fighting clothing does not afford the wearer any protection against chemical contact, but can be worn at chemical incidents if the following conditions are met:

1. Unlikely contact due to splashes.
2. Atmospheric concentrations do not contain levels of chemicals toxic through the skin.
3. No adverse effects would occur if the small areas of unprotected skin were contacted by the chemicals.
4. The air is monitored periodically to evaluate levels of contaminant.

11.6: Fabric and leather gloves should not be used at hazardous materials incidents as they will absorb liquids resulting in exposure to the chemicals. Depending on the materials involved, and other factors such as length of contact time, it may be necessary to discard all protective clothing worn by emergency response personnel.

11.7: There will be incidents involving hazardous materials where structural fire fighting clothing will not provide adequate protection. The hazards of many materials and their potential harm will require donning special protective clothing. *Simply defined, "special protective clothing refers to clothing specially designed to protect against a specific hazard."*

11.8: A concentration of a toxic substance in the air indicates the use of a fully encapsulated suit (Level A), but for non-airborne concentrations of chemicals, a hooded, high quality chemical resistant suit (Level B) may provide adequate protection. The selection of encapsulating suits over non-encapsulating suits is a judgment that should be made by qualified personnel.

11.9: Personnel not protected with at least Level B (non-encapsulating clothing) shall remain upwind and out of the potential dispersion area until the material has been identified and the proper level of protection has been determined.

11.10: To select the required level of personal protection at a hazardous materials incident, the material involved must be identified and the hazards of that material must be determined. Proper identification is the foundation upon which all subsequent decision making is based.

11.11: The level of protective clothing for the Hot and Warm Zones shall be specified by the Unit Leader, HMRT Officer and Safety Officer.

11.12: When deemed necessary for meeting the tasks at hand, approved self-contained compressed air breathing apparatus may be used with approved cylinders from other approved self-contained compressed air breathing apparatus provided that such cylinders are of the same capacity and pressure rating. All compressed air cylinders used with self contained breathing apparatus shall meet U.S. Department of Transportation and National Institute for Occupational Safety and Health criteria.

11.13: Personal protective equipment (PPE) shall be selected and used which will protect employees from the hazards and potential hazards they are likely to encounter as identified during the site characterization and analysis. PPE selection shall be based on an evaluation of the performance characteristics of the PPE relative to the requirements and limitations of the site, the task-specific conditions and duration, and the hazards and potential hazards identified at the site.

11.14: Respiratory protection is a primary concern when wearing personal protective clothing and equipment. The respiratory system is the most exposed, direct, and generally the most critical exposure route. Positive pressure

self-contained breathing apparatus, or positive pressure air-line respirators equipped with an escape air supply, shall be used when chemical exposure levels present will create a substantial possibility of immediate death, immediate serious illness or injury, or impair the ability to escape.

11.15: Totally-encapsulated chemical protective suits (protection equivalent to Level A protection as recommended in Appendix A) shall be used in conditions where skin absorption of a hazardous substance may result in a substantial possibility of immediate death, immediate serious illness or injury, or impair the ability to escape.

11.16: The level of protection provided by PPE selection shall be increased when additional information on site conditions indicates that increased protection is necessary to reduce employee exposures below permissible exposure limits and published exposure levels for hazardous substances and health hazards. (Refer to Appendix A for guidance on selecting PPE ensembles.)

11.17: All personnel must be protected with appropriate personal protective clothing and SCBA during an incident. Emergency response experience has shown that emergency responders are often provided with incomplete or inaccurate information in the initial stages of the incident. The use of lower levels of personal protection can result in a loss of both critical time or injury as responders discover that they are inadequately protected to handle the actual problem.

11.18: PPE should not be downgraded unless the Incident/Scene Commander, the Operations Chief, and/or the Safety Officer are satisfied that the following criteria have been met:

- The hazard area has been isolated and all unnecessary personnel have been denied entry.
- The need for rescue has been determined and performed, as necessary.
- The hazards and risks have been fully evaluated and hazard information has been verified.
- The atmosphere has been checked and documented by a qualified individual and has been verified to be greater than 19.5% oxygen, but not more than 23% oxygen.

CAUTION: Some gases, such as nitrogen, are tasteless, colorless and odorless. Never enter a process area or a confined space to rescue a victim unless wearing SCBAs, *with the exception that if the atmosphere has been tested and verified by a qualified individual to be non-hazardous, authorization may be given to downgrade the level of respiratory protection once all of the appropriate precautions have been taken to minimize the potential for the release of contaminants.*

- The atmosphere has been checked by a qualified individual and has been verified to be below the *Permissible Exposure Limit* (PEL) or the *Threshold Limit Value - STEL* (TLV/STEL) for the chemicals involved.
- The source of the fire or release has been identified, verified and brought under control.

11.19: If the appropriate safe operating criteria have been satisfied, the Incident Commander may determine that the level of protective clothing or equipment may be downgraded. Examples of downgrading include removing SCBAs in favor of air purifying respirators for the chemical(s) present, or removal of structural firefighting gear in favor of fire retardant coveralls.

11.20: A variety of materials are used to make the fabric from which clothing is manufactured. Each material will provide protection against certain specified chemicals or mixtures of chemicals. It may afford little or no protection against certain other chemicals. It is most important to note that there is no material that provides satisfactory protection from all chemicals.

NOTE: A comprehensive *Personal Protective Equipment Program* is included as part of this *Hazardous Materials Emergency Response Plan* in Appendix E.

12. TERMINATION OF INCIDENT

12.1: Safely terminating the incident requires that all direct threats to the health and safety of personnel operating at the scene of the incident have been controlled and/or stabilized. Although operational health and safety hazards may remain, the problem(s) which initially created the problem/threat have been brought under control or isolated.

12.2: The Incident Commander will terminate the incident once all potential hazards are successfully mitigated and it is determined that the site no longer presents safety and/or health hazards to personnel and it is safe to work in the area without the use of personal protective clothing and equipment, including respiratory protection.

NOTE: As long as the Hazardous Materials Response Team (HMRT) is still in control of the incident site and a safety and health hazard exists, the "emergency situation" continues to be in effect. Once the Incident Commander has declared the response activity over and the immediate threat has been stabilized, any remaining clean-up would be considered a post-emergency operation.

12.3: Monitoring is a critical health and safety function in determining at what point it is safe to downgrade the level of the incident. Decisions regarding the downgrading of personal protective clothing and equipment, changing the size of control zones, and evaluating any related employee protective actions should be based upon the results of a continuous site monitoring program.

Suggested parameters for terminating the emergency phase are as follows:

1) *Flammability* - if dealing with a confined space or indoor release, monitoring readings have dropped below 10% of the lower explosive limit (LEL). If dealing with an open-air release, monitoring readings have dropped below 20% of the LEL. Areas above these action values should be isolated and regarded as the hot zone.

2) *Oxygen* - oxygen levels are greater than 19.5% oxygen and less than 23.5% oxygen. In evaluating an oxygen deficient atmosphere, consider that the level of available oxygen may be influenced by contaminants which are present. Areas less than 19.5% or greater than 23.5% oxygen should be isolated and regarded as the hot zone.

3) *Toxicity* - toxicity monitoring readings are less than TLV/TWA or PEL exposure values. Control zones should be maintained for toxic materials using the following guidelines:

    - *Hot Zone* - monitoring readings above IDLH exposure values.
    - *Warm Zone* - monitoring readings equal to or greater than TLV/TWA or PEL exposure values.
    - *Cold Zone* - monitoring readings less than TLV/TWA or PEL exposure values.

4) *Energy Sources* - all sources of energy have either been isolated or restored to a safe state. This would include electrical, hydraulic, mechanical and high temperature sources.

5) *Radioactivity* - no positive readings above background level which would confirm the continued existence of a radiation hazard.

12.4: The Incident Commander must convey information on all of the hazards that may still remain at a post-emergency clean-up site to employees who are involved in the clean-up operations. The individuals/organization who will take control of the site to perform clean-up also have a responsibility to contact the Incident Commander to determine if there are any remaining hazards or any special conditions on-site.

12.5: Personal protective clothing and equipment (PPE) requirements during post-emergency operations will be determined by the Incident Commander in consultation with the Safety Officer. Requirements will be based upon the results of air monitoring, hazards present, the potential for reignition, and other related factors. PPE requirements shall take into account the overall safety of personnel, including considerations such as mobility, comfort, and heat stress.

12.6: All hazardous areas remaining after the termination of the emergency must be identified, secured, and marked off with warning tape, signs, etc. Only essential personnel with the appropriate level of training and personal protective equipment should be permitted to work in the hazard area.

12.7: The IC shall ensure the hazardous material is properly contained for subsequent and proper disposal, shall make every possible effort to locate the responsible party for the incident, and request that they take prompt and appropriate remedial actions. The responsible party shall make the contact for clean-up or removal of the material.

12.8: The IC will take action as necessary to ensure restoration of the scene to a normal condition after the emergency.

12.9: The role of the (*Insert Name of Organization*) NOT to clean-up, but to stabilize the incident. Only a Division Commander can approve department active involvement in clean-up of hazardous materials.

13. INCIDENT ANALYSIS, REPORTS AND DOCUMENTATION

Post Incident Analysis:

13.1: The post-incident analysis is a reconstruction of the incident to establish a clear picture of the events that occurred. The primary objective of the post-incident analysis is the improvement of future emergency response operations.

13.2: A post incident assessment (critique) / debriefing session should be scheduled as soon as practicable after each hazardous materials incident. The objective of the assessment is to identify both strong and weak points of the command and control functions. Officers who participated at the incident along with other interested department personnel should attend. Photographs, color slides, video tapes, and news clips could be used in the assessment. This review will normally be facilitated by the individual in charge of the site.

13.3: An individual or committee is selected to collect information pertaining to incident operations, as well as issues raised at the debriefing session. This will guarantee that sensitive or unverified information is not improperly released. A checklist of key data and documentation should include the following elements:

- Information on the cause of the incident and contributing factors.
- Records of command post actions or decisions.
- Photographs or video tapes.
- Chemical hazard information from available resources.
- Records on levels of exposure and decontamination.
- Incident reports.
- Tactical information used at the Command Post.
- Other relevant documentation or records.

13.4: Additional information can be acquired from interviews with fire department / law enforcement personnel, witnesses, and any photographs or video tapes made of the incident. When all data is assembled and a report is prepared, the report should be reviewed by those personnel involved in the event to verify the contents, and then submitted to management for approval. Once completed, the analysis can then commence.

13.5: Post-incident analysis should focus upon five key topics:

1) **Command and Control**. Was the *Incident Command System* established and was the response organized according to the existing *Emergency Response Plan* and/or SOPs? Did information pass through appropriate channels? Were investigative objectives communicated to appropriate personnel who were expected to implement them?

2) **Tactical Operations**. Were tactical operations implemented by investigators effective? What worked? What did not? How was the level of coordination between agency personnel on the scene?

3) **Resources**. Were resources adequate to conduct the effort? Are improvements needed to equipment or facilities? Were personnel trained adequately for their assignments?

4) **Support Services**. Were support services adequate and provided in a timely manner? What is needed to increase the provision of support to the necessary level?

5) **Plans and Planning**. Were the *Emergency Response Plan* (ERP) and associated procedures current? Did they adequately cover notification, assessment, response, decontamination and termination? Were roles and assignments clearly defined? How will emergency plans and procedures be upgraded to reflect the "lessons learned?"

13.6: Once the post-incident analysis is completed, it should be forwarded to management for review and then distributed to those responsible for appropriate action. Conclusions and recommendations should be incorporated into the existing *Emergency Response Plan* and procedures or used as the basis for developing a revised *Emergency Response Plan*.

13.7: An effective incident critique or self-evaluation supported by senior management is a positive way to outline and discuss lessons learned. Critiques will be conducted following incidents in accordance with established procedures.

13.8: The purpose of a critique is to develop recommendations for improving the organization's capabilities and operations rather than to find fault with the performance of personnel. The crucial player in the critique is the facilitator who leads the process. A facilitator can be any individual who is: (1) comfortable and effective working in front of a group; (2) knowledgeable about the ERP and SOPs; and (3) experienced in conducting investigations. The facilitator will typically be the Fire / Arson Investigation Unit Manager / Supervisor.

13.9: The facilitator will control the critique and should perform the following tasks:

- Introduce the participants and procedures, and keep the critique moving according to schedule.
- Ensure that direct questions receive direct answers.
- Ensure that all participants adhere to critique guidelines.
- Ensure that each operational group presents their observations or comments.

13.10: The following is a recommended critique format for large scale incidents involving hazardous substances:

1) **Participant Critique**. Each individual makes a statement relevant to their performance and what they feel are the major issues. Depending upon time, more detail may be added. There should be no interruptions during this phase.

2) **Operations Critique**. Participants then comment on the strengths and weaknesses of each section/sector's actions and contributions. Through a spokesperson, each section/sector presents problems encountered, unanticipated events, and lessons learned. Each presentation should not exceed five minutes.

3) **Session Critique**. At the end of the critique, participants focus upon the problems that should be addressed by each group. The facilitator encourages discussion, reinforces constructive comments, and records important points.

13.11: An attempt should be made to have representatives from all participating agencies/organizations at the critique. If possible all participants in the emergency response operation should be present for the critique. The purpose of the *Critique Procedure* is to enable personnel participating in incidents and site management to review actions taken to investigate incidents in a formal discussion and develop action plans to improve and efficiently respond to future incidents.

Reports:

13.12: The incident report shall be compiled and prepared and should include data submitted by the involved departments/agencies; summarize salient topics of discussion during the post incident review; be objective (no fault) in nature; and emphasize lessons learned.

13.13: An incident report, to include a detailed description of the incident, is to be filed within _____ days (*Specify Appropriate Time Period*) upon the conclusion of the incident. This report should include:

- All operational phases of the incident, as appropriate
- All equipment or supplies used during the incident
- The names and telephone numbers of all key individuals
- Contributing factors leading up to the incident
- Root cause(s) of the incident
- Injuries, fatalities, or exposures
- Results of any laboratory analyses performed on evidence
- Information obtained from interviews
- Opinion as to origin and cause of the incident
- Recommendations to prevent future incidents
- Follow-up actions, if required (e.g., criminal investigation)

13.14: The following procedures are designed to maintain accurate and useful documentation during an incident investigation:

1) Information should be legibly printed in ink. If weather conditions do not permit this, pencil or other writing materials may be used.

2) The language should be objective, factual, and free of personal feelings or terminology that detract from recording the information accurately and concisely.

3) Whenever possible, entries should be made contemporaneously. The times of observations should also be noted.

4) The following background information should be detailed, including:

    - Date and time of the incident
    - Location of the emergency
    - Brief description of the type of incident (*e.g., fire, rescue, etc.*)
    - Weather conditions
    - Personnel on-site, including employees, public safety agencies, insurance representatives, etc.
    - Summary of activities

5) Maintain a chronicle of incident activities, events, and changing conditions. Note the following types of information which is pertinent to documenting incident activities and status:

    - Arrival and departure times of personnel
    - Proposed strategies and tactics, with supporting rationale
    - Consequences or outcomes of countermeasures
    - Levels of PPE used on-site
    - Qualitative and quantitative description of ambient conditions
    - Meteorological information

- Site sketch and other field observations

6) If photographs or video tapes are taken, copies should also be obtained for the incident file. With respect to future litigation, the following information should be recorded with respect to photos and video tapes:

    - Time, date, location, direction and weather conditions
    - Description or identification of subject and relevance of photographs
    - Sequential number of photos and film roll number(s)
    - Camera type and serial number
    - Name of photographer

13.15: An incident logbook should be maintained for future reference, and as a minimum should contain the following data:

- Location.
- Date.
- Name, description, source, material(s) involved and cause of incident.
- Weather information.
- Names and job assignments for all personnel involved.
- Injuries to personnel and public.
- Corrective action taken.
- Chronological recording of events.
- Entry and exit times of the entry personnel.
- Method of recording exposure of personnel to hazardous materials.
- Resource personnel data.

13.16: All logbooks and supporting documentation should be collected by the senior investigator in charge at the termination of the incident and maintained in an incident file. This file will be available for reference in the event of similar incidents. The incident file should contain the following items:

- Field reports
- Logbooks and operational checklists
- Press releases
- Statements from governmental agencies or the public
- Photographs
- Costs incurred, including cost documentation
- Other pertinent information

APPENDIX A
GENERAL DESCRIPTION AND DISCUSSION OF THE LEVELS OF PROTECTION AND PROTECTIVE GEAR

A.1: This appendix sets forth information about personal protective equipment (PPE) protection levels which may be used to assist agencies in complying with the PPE requirements of this section.

A.2: As required by the standard, PPE must be selected which will protect employees from the specific hazards which they are likely to encounter during their work on-site.

A.3: Selection of the appropriate PPE is a vital process that must consider a variety of factors. Key factors involved in this process are identification of the hazards or suspected hazards; their routes of potential hazard to employees (inhalation, skin absorption, ingestion and eye or skin contact); and the performance of the PPE materials (and seams) in providing a barrier to these hazards. The amount of protection provided by PPE is material-hazard specific. That is, protective equipment materials will protect well against some hazardous substances and poorly, or not at all, against others. In many instances, protective equipment materials cannot be found which will provide continuous protection from the particular hazardous substance. In these cases the breakthrough time of the protective material should exceed the work durations, or the exposure after breakthrough must not pose a hazardous level.

A.4: Other factors in this selection process to be considered are matching the PPE to the employees work requirements and task-specific conditions. The durability of PPE materials, such as tear strength and seam strength, should be considered in relation to the employee's tasks. The effects of PPE in relation to heat stress and task duration are a factor in selecting and using PPE. In some cases layers of PPE may be necessary to provide sufficient protection, or to protect expensive PPE inner garments, suits or equipment.

A.5: The more that is known about the hazards at the site, the easier the job of PPE selection becomes. As more information about the hazards and conditions at the site becomes available, the site supervisor can make decisions to up-grade or down-grade the level of PPE protection to match the tasks at hand.

A.6: The following are guidelines that can be used to begin the selection of the appropriate PPE. As noted above, the site information may suggest the use of combinations of PPE selected from the different protection levels (i.e., A, B, C, or D) as being more suitable to the hazards of the work. It should be cautioned that the listing below does not fully address the performance of the specific PPE material in relation to the specific hazards at the job site, and that PPE selection, evaluation and re-selection is an ongoing process until sufficient information about the hazards and PPE performance is obtained.

A.7: **PART A:** Personal protective equipment is divided into four categories based on the degree of protection afforded. (See **Part B** of this appendix for further explanation of Levels A, B, C, and D hazards.)

I. LEVEL A - To be selected when the greatest level of skin, respiratory, and eye protection is required.

A.8: The following constitute Level A equipment; it may be used as appropriate;

1. Positive pressure, full face-piece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA, approved by the National Institute for Occupational Safety and Health (NIOSH).
2. Totally-encapsulating chemical-protective suit.
3. Coveralls.*
4. Long underwear.*
5. Gloves, outer, chemical-resistant.
6. Gloves, inner, chemical-resistant.
7. Boots, chemical-resistant, steel toe and shank.
8. Hard hat (under suit).*
9. Disposable protective suit, gloves and boots (depending on suit construction, may be worn over totally-encapsulating suit).

II. LEVEL B - The highest level of respiratory protection is necessary but a lesser level of skin protection is needed.

A.9: The following constitute Level B equipment; it may be used as appropriate.

1. Positive pressure, full-facepiece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA (NIOSH approved).
2. Hooded chemical-resistant clothing (overalls and long-sleeved jacket; coveralls; one or two-piece chemical-splash suit; disposable chemical-resistant overalls).
3. Coveralls.*
4. Gloves, outer, chemical-resistant.
5. Gloves, inner, chemical-resistant.
6. Boots, outer, chemical-resistant steel toe and shank.
7. Boot-covers, outer, chemical-resistant (disposable).*
8. Hard hat.*
9. (Reserved.)
10. Face shield.*

*** Optional, as applicable**

III. LEVEL C - The concentration(s) and type(s) of airborne substance(s) is known and the criteria for using air purifying respirators are met.

A.10: The following constitute Level C equipment; it may be used as appropriate;

1. Full-face or half-mask, air purifying respirators (NIOSH approved).
2. Hooded chemical-resistant clothing (overalls; two-piece chemical-splash suit; disposable chemical-resistant overalls).
3. Coveralls.*
4. Gloves, outer, chemical-resistant.
5. Gloves, inner, chemical-resistant.
6. Boots (outer), chemical-resistant steel toe and shank.*
7. Boot-covers, outer, chemical-resistant (disposable).*
8. Hard hat.*
9. Escape mask.*
10. Face shield.*

IV. LEVEL D - A work uniform affording minimal protection, used for nuisance contamination only.

A.11: The following constitute Level D equipment; it may be used as appropriate:

1. Coveralls.
2. Gloves.*
3. Boots/shoes, chemical-resistant steel toe and shank.
4. Boots, outer, chemical-resistant (disposable).*
5. Safety glasses or chemical splash goggles.*
6. Hard hat.*
7. Escape mask.*
8. Face shield.*

*** Optional, as applicable**

A.12: **PART B:** The types of hazards for which levels A, B, C, and D protection are appropriate are described below:

A.13: **LEVEL A - Level A protection should be used when:**

1. The hazardous substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either the measured (or potential for) high concentration of atmospheric vapors, gases or particulates; or the site operations and work functions involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to the skin or capable of being absorbed through the intact skin;

2. Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible; or

3. Operations must be conducted in confined, poorly ventilated areas, and the absence of conditions requiring Level A have not yet been determined.

A.14: **LEVEL B - Level B protection should be used when:**

1. The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection;

2. The atmosphere contains less than 19.5 percent oxygen; or

3. The presence of incompletely identified vapors or gases is indicated by a direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin.

NOTE: This involves atmospheres with IDLH concentrations of specific substances that present severe inhalation hazards and that do not represent a severe skin hazard; or that do not meet the criteria for use of air purifying respirators.

A.15: **Level C protection should be used when:**

1. The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin;

2. The types of air contaminants have been identified, concentrations measured, and an air-purifying respirator is available that can remove the contaminants; and

3. All criteria for the use of air purifying respirators are met.

A.16: **Level D protection should be used when:**

1. The atmosphere contains no known hazard; and

2. Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

A.17: **NOTE**: - As stated before, combinations of personal protective equipment other than those described for Levels A, B, C, and D protection may be more appropriate and may be used to provide the proper level of protection.

A.18: As an aid in selecting suitable chemical protective clothing, it should be noted that the National Fire Protection Association ihas developed the following set of standards on chemical protective clothing. These standards include:

1. NFPA 1991--*Standard on Vapor-Protective Suits for Hazardous Chemical Emergencies* (EPA Level A Protective Clothing).

2. NFPA 1992--*Standard on Liquid Splash-Protective Suits for Hazardous Chemical Emergencies* (EPA Level B Protective Clothing).

3. NFPA 1993--*Standard on Liquid Splash-Protective Suits for Non-emergency, Non-Flammable Hazardous Chemical Situations* (EPA Level B Protective Clothing).

A.19: These standards would apply documentation and performance requirements to the manufacture of chemical protective suits. Chemical protective suits meeting these requirements would be labeled as compliant with the appropriate standard.

APPENDIX B
DECONTAMINATION

B.1: Decontamination-General. Procedures for all phases of decontamination shall be developed and implemented in accordance with this appendix.

B.2: Decontamination procedures.

1. A decontamination procedure shall be developed, communicated to employees and implemented before any employees or equipment may enter areas on site where potential for exposure to hazardous substances exists.

2. Standard operating procedures shall be developed to minimize contact with hazardous substances or with equipment that has contacted hazardous substances.

3. All employees leaving a contaminated area shall be appropriately decontaminated; all contaminated clothing and equipment leaving a contaminated area shall be appropriately disposed of or decontaminated.

4. Decontamination procedures shall be monitored by the site safety and health supervisor to determine their effectiveness. When such procedures are found to be ineffective, appropriate steps shall be taken to correct any deficiencies.

B.3: Location. Decontamination shall be performed in geographical areas that will minimize the exposure of uncontaminated employees or equipment to contaminated employees or equipment.

B.4: Equipment and solvents. All equipment and solvents used for decontamination shall be decontaminated or disposed of properly.

B.5: Personal protective clothing and equipment.

1. Protective clothing and equipment shall be decontaminated, cleaned, laundered, maintained or replaced as needed to maintain their effectiveness.

2. Personnel whose non-impermeable clothing becomes wetted with hazardous substances shall immediately remove that clothing and proceed to shower. The clothing shall be disposed of or decontaminated before it is removed from the work zone.

B.6: Unauthorized personnel. Unauthorized personnel shall not remove protective clothing or equipment from changing rooms.

B.7: Commercial laundries or cleaning establishments. Commercial laundries or cleaning establishments that decontaminate protective clothing or equipment shall be informed of the potentially harmful effects of exposures to hazardous substances.

B.8: Showers and change rooms. Where the decontamination procedure indicates a need for regular showers and change rooms outside of a contaminated area, they shall be provided and meet the requirements of Title 29 CFR 1910.141. If temperature conditions prevent the effective use of water, then other effective means for cleansing shall be provided and used.

B.9: Decontamination procedures should begin upon arrival at the scene, should provide for an adequate number of decontamination personnel, and continue until the Incident Commander determines that decontamination procedures are no longer required. Decontamination of victims may be required. Using solutions containing chemicals to alter or change contaminants to less hazardous materials should be done only after consultation with persons experienced and familiar with the hazards involved.
The use of detergent-water washing solutions is more prevalent. Its effectiveness against certain contaminants may be low, but it is less risky than using chemical solutions.

APPENDIX C
EIGHT STEP INVESTIGATIVE PROCESS©

A safe and effective fire or explosion scene examination, and accurate origin and cause determination at incidents involving hazardous materials or hazardous wastes, must be based on a structured system and standard operating procedures (SOPs). The *Eight Step Process*©, which is widely used throughout the country by public and private sector hazardous materials response teams for hazardous materials incident management, is an example of a structured system that can be adapted to investigations of incidents involving fires, explosions or hazardous materials and hazardous wastes.

The *Eight Step Process*© is analogous to fireground SOPs that outline basic functions to be completed in a specific order. For example, fire investigators are familiar with search and rescue, ventilation, fire control and extinguishment, salvage and overhaul, and so forth as applied in structural firefighting operations. As with fireground SOPs, situations will exist in which the investigative functions at major fire and explosion incidents may have to be reordered or completed simultaneously. Finally, like all SOPs, the *Eight Step Process*© should be viewed as a flexible guideline and not as a rigid rule. Individual departments and agencies should decide what works best for them. The *Eight Step Process*© provides investigators with a flexible management system that expands as the scope and magnitude of the incident grows, and finally, it provides a consistent management structure regardless of the types of hazards encountered at the scene. The *Eight Step Investigative Process*© and a brief description of its components are provided below.

STEP 1: SITE MANAGEMENT AND CONTROL

This step includes determining and securing the physical layout of the incident scene. For the fire investigator, it specifically refers to securing the scene and denying entry to unauthorized personnel to preserve and protect any remaining evidence. Site management includes the establishment of command and hazard control zones and the initial deployment of personnel and equipment.

STEP 2: IDENTIFICATION OF THE PROBLEM

This step includes the proper recognition, identification, and verification of the hazardous materials or hazardous wastes involved in the incident. Methods of identification include analyzing container shapes, markings, labels and placards, and facility documents (e.g., Material Safety Data Sheets); monitoring and detection equipment; and identification by the senses (i.e., physical observations, smell, etc.). Investigators should remember that even when the hazardous substances involved have been identified, the information should *always* be verified.

STEP 3: HAZARD AND RISK ASSESSMENT

A hazard and risk assessment involves assessing the relative hazards of the substance(s) and evaluating the risks to personnel, property, and the environment. Investigators should view their roles as risk evaluators, rather than risk takers, when investigating incidents where hazardous materials or hazardous wastes are involved. This task includes gathering hazard data from technical reference sources such as Emergency Response Guidebooks, Technical Information Centers such as CHEMTREC®, electronic data bases such as CAMEO, Material Safety Data Sheets, company technical specialists, or reviewing air monitoring results, if conducted prior to the arrival of investigators. This information should be compiled in a format such as a checklist and used to evaluate the risks. If there is evidence that hazardous materials may be present, continuously monitor the area with appropriate air monitoring equipment to evaluate flammable or toxic concentrations in air. For example, flammability readings higher than 10% indicate an immediate fire or explosion hazard, and operations should be suspended until readings are reduced below 10%.

STEP 4: SELECTION OF THE PROPER LEVEL OF PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT

Based upon the results of the hazard and risk assessment process, investigators will select the proper level of personal protective clothing and equipment. Two primary types of personal protective clothing are used at hazardous materials incidents: (1) structural firefighting protective clothing, and (2) chemical protective clothing. **Investigators should remember that structural firefighting protective clothing is not designed to provide protection against chemical hazards.**

STEP 5: COORDINATION OF INFORMATION AND RESOURCES

This step refers to the proper management, coordination, and dissemination of all pertinent data and information within the ICS in effect at the scene. Of particular importance is the ability to determine the incident factors involved, which functions of the *Eight Step Investigative Process*© have been completed, what additional information must be obtained, and what incident factors remain unknown.

STEP 6: SELECTION AND IMPLEMENTATION OF INVESTIGATIVE OBJECTIVES

This step refers to the implementation of the appropriate investigative activities to enter the scene safely and perform a preliminary examination into the origin and cause of the incident. These tasks consist of: (1) initial site entry and monitoring to determine the extent of the hazards present; (2) an evaluation of the scene to locate evidence that can be used to reconstruct the events leading up to the incident; (3) identification of the contributing factors that caused the incident; (4) interviewing on-scene personnel and witnesses to corroborate the information obtained and opinions formed based on the available data; and (5) documentation of preliminary results.

STEP 7: DECONTAMINATION PROCEDURES

This step refers to the process of making personnel, equipment, and supplies "safe" by reducing or eliminating harmful substances (i.e., contaminants) that are present when entering and working in contaminated areas (i.e., hot zone). Although decontamination is commonly addressed in terms of "cleaning" personnel and equipment after entry operations, investigators should remember that in some instances, due to the nature of the hazardous substances involved, decontamination of clothing and equipment may not be possible and these items may require disposal. Investigators should consult with environmental officials and technical specialists, if necessary, to determine the appropriate disposal methods and procedures based on applicable federal, state, and local regulations.

STEP 8: TERMINATION PROCEDURES

This step refers to the process of documenting the results of the investigation, which should include, at a minimum, the material(s), personnel, and resources involved, site operations, contributing factors leading up to the event, any evidence collected and the results of any laboratory analyses performed, witness statements, identification of the root cause(s) of the incident, follow-up activities (e.g., possible criminal investigation), if required, and any supporting documentation (e.g., relevant codes and standards) to support the findings. Of particular importance is the documentation of all injuries, exposures, and fatalities as a result of the incident, and the dissemination of any pertinent follow-up information such as recommendations to prevent similar events in the future and improved safety procedures. Checklists often can be of assistance to ensure that important steps and essential information to the investigation are not overlooked. Although the level of equipment, training, and personnel may vary among departments, basic tasks and functions should be accepted and implemented on a consistent basis. The *Eight Step Investigative Process*© provides the framework necessary to translate planning and preparedness into the delivery of an effective system for investigating incidents where hazardous materials or hazardous wastes are involved.

NOTE: A sample *Hazardous Materials Incident Investigation Checklist* based on the *Eight Step Process*© is included on the following page. This checklist can be used as a guideline by investigators and modified as necessary.

HAZARDOUS MATERIALS INCIDENT INVESTIGATION CHECKLIST©

NOTE: The following guidelines for investigative operations at incidents involving hazardous materials are based upon the *Eight Step Incident Management Procedure*©, developed by Hildebrand and Noll Associates, Inc. Additional information can be referenced from the textbook *Hazardous Materials: Managing the Incident* published by Fire Protection Publications, Oklahoma State University.

DATE / TIME: _____

NATURE OF INCIDENT: _____

LOCATION: _____

REQUESTED BY: _____

INCIDENT COMMANDER: _____

STEP 1 - SITE MANAGEMENT AND CONTROL

- POSITION PERSONNEL AND VEHICLES UPWIND AND UPGRADE
- SECURE THE AREA AND DENY ENTRY
- IDENTIFY THE MATERIAL(S) INVOLVED
- EVALUATE THE HAZARDS AND RISKS - CONDITION OF SCENE
  - Health
  - Flammability
  - Reactivity
  - Physical Properties
- IS SPECIALIZED ASSISTANCE NEEDED? (e.g., Hazardous Materials Response Team, BATF National Response Team, Police Bomb Squad, State Fire Marshal Bomb Technician, etc.)
  - IF YES - Advise Incident Commander / Communications
  - IF NO - Handle Incident According to Eight Step Investigative Process©

- Determine the extent of the hazard area.
- Establish control of the hazard area.
- Determine the boundaries of hazard control zones (Hot, Warm, Cold).
- Restrict access to the emergency site to authorized essential personnel only; all non essential personnel should be isolated from the site.
- The location of the restricted area (i.e., hot zone) should be identified and communicated to all personnel operating on the site. Methods of identifying the restricted area would include barricade tape, traffic cones, visible landmarks, etc.
- During approach to the incident scene, avoid committing or positioning personnel and vehicles in a hazardous position or situation.
- Assess the situation and consider having an escape route out of the area if the situation should suddenly deteriorate.

CAUTION: Personnel must be aware that certain chemical releases may travel throughout the immediate area and downwind and impact emergency response routes. In addition, some chemicals may produce vapor clouds that can be mistaken for fog or other normal weather and environmental conditions. Examples of such chemicals would include chlorine, ammonia, sulfuric acid and a variety of agricultural chemicals.

STEP 2 - IDENTIFY THE PROBLEM

- Identify the nature and severity of the immediate problem, including the recognition, identification, and verification of the substance(s) involved and any potential or existing life hazards. If multiple problems exist, prioritize them and make independent assignments.

- Obtain all available information concerning the identity of the substance(s) involved. Write down all information obtained and verify the source and accuracy of all information.

- As necessary, determine the following:

    - What hazard(s) is involved and what materials are burning and/or being released?
    - Was the original event observed by any witnesses?

STEP 3 - EVALUATE THE HAZARDS AND RISKS

- Evaluate the overall incident situation, including:

    - Previous and current status of the incident.
    - Were any abnormal conditions observed immediately before the event?

- Overall condition of the incident scene:

    - Electrical hazards. Have power and all other energy sources been isolated?
    - Falling debris
    - Confined space

- Environmental conditions, including runoff, wind, precipitation, topography, etc.

    - Are materials floating on water?
    - Is the runoff hazardous to personnel?

- Comparison of resources available vs. the level required to handle the problem effectively.

- Modifications to the suggested size and perimeters of the hazard control zones.

- Monitor the emergency scene to determine the concentrations of contaminants present (e.g., oxygen deficiency, flammability, toxicity) and their approximate locations.

CAUTION: Personnel taking air samples must use proper personal protective equipment (PPE) and self-contained breathing apparatus (SCBA) to match the potential hazard(s).

- Based upon the hazard and risk assessment process, determine the manner in which the incident should be handled and evaluate the following concerns:

    - Health
    - Flammability
    - Reactivity
    - Physical and Chemical Properties
    - Exposures

STEP 4 - SELECT THE PROPER LEVEL OF PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT

- The selection of the proper type and level of personal protective clothing and equipment will depend upon the hazards and properties of the material(s) involved and the objectives to be implemented. In evaluating the use of specialized protective clothing, the following factors must be considered:
    - The hazard(s) to be encountered, including the specific tasks to be performed.
    - The level and type of specialized protective clothing to be utilized.
    - The user, or the individual(s) who will use the PPE in a hostile environment. Remember: Specialized protective clothing places a great deal of physiological and psychological stress on an individual.
- The following levels of personal protective clothing may be required at incidents involving hazardous materials:
    - **Structural Firefighting Protective Clothing** -- A helmet, fire retardant hood, turnout coat, running pants and gloves, and positive-pressure, self-contained breathing apparatus (SCBA) should be considered the minimum level of protective clothing. *Structural firefighting clothing is NOT designed to offer any chemical protection,* and turnout boots will provide only limited protection against liquids in-depth. Personnel should be aware of the potential chemical burn hazards associated with the runoff water and accumulated liquids that may exist at a fire/explosion scene, and they should avoid kneeling in areas where such hazards exist.
    - **Chemical Vapor Protective Clothing** -- This is specialized chemical protective clothing which, when used in conjunction with air supplied respiratory protection devices, offers a sealed, integral level of full-body protection from a hostile environment. It is primarily designed to offer protection from both gases and vapors, as well as total body splash protection. It may also be referred to as EPA Level A chemical protective clothing.
    - **Chemical Liquid Splash Protective Clothing** -- This is specialized protective clothing that protects the wearer against chemical liquid splashes but not against chemical vapors or gases. It is primarily designed to provide personal protection against liquid splashes, solids, dusts, and particles. It can be found in both single and multi-piece garment arrangements and may also be referred to as EPA Level B chemical protective clothing.
- Ensure that all personnel are using the proper protective clothing and equipment equal to the hazards present. *Do not place personnel in an unsafe emergency situation.*
- Order additional resources and other specialized equipment and expertise early in the incident, if required. If unsure what the requirements are, always call for the highest level of assistance available. *Do not wait to call for additional assistance if the circumstances may warrant it.*

STEP 5 - COORDINATE INFORMATION AND RESOURCES

- Confirm that the Command Post is in a safe area. The Command Post must be physically separated from all emergency response personnel and units involved in the tactical operation. *All personnel not directly involved in the overall command and control of the incident should vacate the Command Post area.*
- Ensure that all appropriate internal and external notifications have been made, if required.
- Coordinate information and provide briefings to the Incident Commander and federal, state and local governmental authorities (e.g., fire department, police department), as required.

STEP 6 - SELECT AND IMPLEMENT INVESTIGATIVE OBJECTIVES

- Implement investigative objectives. Remember, evaluate the risks before entering the hazard area to conduct operations in the hot zone.

- Ensure that properly equipped back-up personnel wearing the appropriate level of personal protective clothing are in place before initiating operations.

- Verify that Entry Teams have been briefed prior to being allowed to enter the hot zone. For hazardous materials emergencies, include the following:

    - Removal of all watches, jewelry, and personal valuables
    - Objectives of the entry operation
    - Radio communications, SCBA and PPE checks
    - Emergency escape signals
    - Decontamination area location, set-up and procedures

- Coordinate operations with the Site Safety Officer.

- Will decontamination be required after entry operations are completed? Is the Decontamination Area set up and ready?

- ALWAYS CONDUCT OPERATIONS AS SAFELY AS POSSIBLE. DO NOT ENTER THE HAZARD AREA UNLESS PROPERLY TRAINED AND EQUIPPED FOR THE HAZARD(S) PRESENT AND THE SPECIFIC TASK(S) TO BE PERFORMED.

STEP 7 - DECONTAMINATION PROCEDURES

- Ensure that the appropriate decontamination procedures are determined, verified, and coordinated with on-scene personnel. Ensure the following:

    - The decontamination area is properly located within the warm zone, preferably uphill and upwind of the incident location.

    - The decontamination area is well-marked and identified.

    - The proper decontamination method(s) and the type of personal protective clothing to be used by the Decontamination Team have been determined and communicated, as appropriate.

- Ensure that properly equipped back-up personnel wearing the appropriate level of personal protective clothing are in place before initiating operations.

- Ensure proper decontamination of emergency personnel before they leave the scene. Hazardous vapors, flammable gases, and some toxic and corrosive gases can saturate protective clothing and be carried into "safe" areas.

- Establish a plan to cleanup or dispose of contaminated supplies and equipment before leaving the incident scene. Federal, state, and local environmental laws require proper disposal of hazardous wastes.

STEP 8 - TERMINATION PROCEDURES

- Account for all personnel before securing site operations.

- Conduct an incident debriefing session for all personnel involved in the investigation. Provide any background information necessary to ensure that personnel exposures are documented, if necessary. Ensure that the following elements are documented:

    - All operational phases of the incident, as appropriate
    - All equipment or supplies used during the incident
    - The names and telephone numbers of all key individuals

- Contributing factors leading up to the incident
- Root cause(s) of the incident
- Injuries, fatalities, or exposures
- Results of any laboratory analyses performed on evidence
- Information obtained from interviews
- Opinion as to origin and cause of the incident
- Recommendations to prevent future incidents
- Follow-up actions, if required (e.g., criminal investigation)

- Ensure that all PPE is reserviced, inspected, and returned to proper locations.

- Prepare required reports and documentation using appropriate forms for submission to supervisory personnel for review and approval.

NOTES:

APPENDIX D
SITE SAFETY PLAN

NOTE: A site-specific *Site Safety Plan* must be developed and implemented for each site where investigators may potentially be exposed to hazardous substances while conducting scene examinations (29 CFR 1910.120 (b)(4)). The purpose of the *Site Safety Plan* is to address the safety and health hazards that may exist at each phase of site operations and to identify procedures for the protection of personnel and the environment. A *Site Safety Plan* shall be prepared and reviewed by qualified occupational health and safety professionals for each hazardous substance response action. The Plan must address the safety requirements for hazardous activities, whether they are routine response activities or unexpected site emergencies. Before site operations commence, all safety aspects of the operations to be performed should be thoroughly examined, and the *Site Safety Plan* must be updated if new tasks or hazards are identified at the site.

A. SITE DESCRIPTION

DATE: _____

LOCATION: _____

TIME OF DAY: _____

INCIDENT #: _____

PRIMARY HAZARDS: _____

Flammability ❑
Health ❑
Reactivity ❑
Other ❑

AREA(S) AFFECTED: _____

IMMEDIATE EXPOSURES: _____

TOPOGRAPHY: _____

WEATHER CONDITIONS: _____

ADDITIONAL INFORMATION: _____

B. KEY PERSONNEL & HAZARD COMMUNICATIONS PLAN

NAMES OF KEY PERSONNEL: (*i.e., Incident Commander, Safety Officer, Supervisor, On-Site Health and Safety Personnel, etc.*). [29 CFR 1910.120 (b)(2)].

_____
_____
_____

COMMUNICATIONS PROCEDURES: (*Means of communicating pertinent information to site personnel before site activities are initiated (e.g., briefings). Personnel should be briefed periodically throughout site operations to ensure that they are adequately apprised of the safety and health procedures being followed at the site*). [29 CFR 1910.120 (b)(2)]. _____

_____
_____
_____

C. HEALTH AND SAFETY RISK ANALYSES

(*Health and Safety Risk Analyses should be established for each task and operation to be performed at the site. Discussion of these analyses should include identification of the chemical contaminant(s) present, affected media, concentrations, and potential routes of exposure. These activities should also include safety risk analyses to address potential on-site operations and safety problems*). [29 CFR1910.120 (b)(4)].

NOTE: An initial *Hazard Evaluation* for the hazardous substances present or suspected to be on-site and their primary hazards can be performed using the following table:

SUBSTANCE(S) INVOLVED	CONCENTRATION(S) IF KNOWN	PRIMARY HAZARDS

The following additional safety and/or health hazards are anticipated on-site: (*e.g., slippery ground, electrical hazards, falling debris, confined space, etc.*). _____

NOTE: Material Safety Data Sheets for the substances involved are attached.

D. SITE CONTROL MEASURES

(*The Site Control Measures are those procedures that will be used to minimize personnel exposure to hazardous substances before site operations commence and during site operations. These procedures must be modified as any new information is obtained with respect to site hazards. These measures should include a site map, designation of hazard control zones, site communications, safety work practices, identification of the nearest medical assistance, description of the "buddy system" for site operations, and emergency alarm procedures*). [29 CFR 1910.120 (d)].

Site Safety: (*Name*) _____ is the designated Site Safety Officer and is directly responsible to the Incident Commander for safety recommendations on-site.

Emergency Medical Care: (*Names of qualified personnel*) _____

(*Medical Facility Names and Addresses*) _____
_____
_
_____
_
_____
_
are located approximately _____ minutes from this location.

(*Name of Person*) _____ was contacted at (*Time*) _____ and briefed on the situation, the potential hazards, and the substances involved. A map of alternative routes to this facility is available at (*normally Command Post*) _____
_____
_____
_

Local ambulance service is available from _____ at (*Phone Number*) _____. Their response time to the site is approximately _____ minutes. Whenever possible, arrangements should be made for on-site stand-by.

First aid equipment is available from the following sources:

_____
_____
_____
_____
_____

Emergency medical information for substances present:

SUBSTANCE(S)	EXPOSURE SYMPTOMS	FIRST AID INSTRUCTIONS

List of Emergency Telephone Numbers:

AGENCY	PHONE NUMBER	CONTACT
Police		
Hospital		
Public Health / EPA / OSHA		
State Fire Marshal		
BATF		

The following standard emergency procedures will be used by on-site personnel. The Site Safety Officer shall be notified of any on-site emergencies and be responsible for ensuring that the appropriate procedures are followed.

Personnel Injury in the Hot Zone: Upon notification of an injury in the Hot Zone, the designated emergency signal _____ shall be sounded. All site personnel shall assemble at the decontamination line. The rescue team will enter the Hot Zone (if required) to remove the injured person(s) to the hotline (*i.e., boundary between hot and warm zone*).

The Site Safety Officer and Incident Commander should evaluate the nature of the injury, and the affected person should be decontaminated to the extent possible prior to movement to the Warm Zone. The on-site EMT / Medical Personnel shall initiate appropriate first aid measures and contact should be made for an ambulance and with the nearest medical treatment facility (if required). **No persons shall reenter the Hot Zone until the cause of the injury or symptoms are determined.**

Personnel Injury in the Warm Zone: Upon notification of an injury in the Warm Zone, the Site Safety Officer and Incident Commander will assess the nature of the injury. If the cause of the injury or loss of the injured person does not affect the performance of site personnel, operations may continue, with the on-site EMT / Medical Personnel administering the appropriate first aid and necessary follow-up as stated above. If the injury increases the risk to others, the designated emergency signal _____ will be sounded and all on-site personnel will move to the decontamination line and await further instructions. Activities on-site will cease until the added risk is removed or minimized.

Fire Explosion: Upon notification of a fire or explosion on-site, the designated emergency signal _____ shall be sounded and all on-site personnel shall assemble at the decontamination line. The fire department shall be alerted and all personnel will be moved to a safe distance from the involved area.

Personal Protective Equipment Failure: If any site worker experiences a failure or alteration of protective equipment that affects the protection factor, that person and his/her buddy shall immediately exit the Hot Zone. Reentry shall not be permitted until the equipment has been serviced or replaced.

Other Equipment Failure: If any other equipment on-site fails to operate properly, the Incident Commander and Site Safety Officer shall be notified and then determine the effect of this failure on continued on-site operations.
If the failure affects the safety of personnel or prevents completion of the work plan tasks, all personnel shall leave the Hot Zone until the situation is evaluated and appropriate actions taken.

Escape Routes: The following emergency escape routes are designated for use in those situations where egress from the Hot Zone cannot occur through the decontamination line: (*Describe alternate routes to leave area in emergencies*).

_____

_____

_____

NOTE: In all situations when an on-site emergency results in evacuation of the Hot Zone, personnel shall not reenter until:

1. The conditions resulting in the emergency have been corrected.
2. The hazards have been reassessed.
3. The *Site Safety Plan* has been reviewed.
4. Site personnel have been briefed on any changes to the *Site Safety Plan*.

On-Site Work Plans: Work parties consisting of _____ persons will perform the following tasks:

PERSONNEL	FUNCTION
Team Leader / Group Supervisor	
Team #1	
Team #2	

PERSONNEL	FUNCTION
Rescue Team (*Required for entry into IDLH Atmospheres*)	
DECON Team	

The work parties were briefed on the contents of this Plan at (*Date, Time, Location*)

Communications Procedures: Channel _____ has been designated as the radio frequency for personnel in the Hot Zone. All other on-site communications will use Channel _____ . Personnel in the Hot Zone should remain in constant radio communication or within sight of the Team Leader/Safety Officer. Any failure of radio communication requires an evaluation of whether personnel should leave the Hot Zone.

(*Horn, Blast, Siren, etc.*) _____ is the emergency signal to indicate that all personnel should leave the Hot Zone immediately. The following standard hand signals will be used in the event of a radio communications failure:

Hand Gripping Throat.....	Out of Air, Can't Breathe
Grip Partner's Wrist or Both Hands Around Waist.....	Leave Area Immediately
Hands On Top of Head.....	Need Assistance
Thumbs Up.....	O.K., I'm Alright
Thumbs Down.....	No, Negative

Telephone communication to the Command Post should be established as soon as practicable. The telephone number is ( ) _____ .

E. EMPLOYEE TRAINING ASSIGNMENTS

(*Training Assignments should address the employee's initial health and safety training, annual health and safety refresher training, on-the-job training, supervisory training, and first-aid/CPR training.* **Employees will not be permitted to participate in any site activities unless they have received training commensurate with their responsibilities**). [29 CFR 1910.120 (e)].

F. MEDICAL SURVEILLANCE

(*A Medical Surveillance Program is required for monitoring the health and safety of personnel engaged in hazardous waste operations and emergency response activities who may be potentially exposed to hazardous substances at the scene and who wear respirators 30 days or more per year. The program must include baseline or preassignment monitoring and periodic medical examinations, examinations upon termination of employment, medical recordkeeping, and exposure/injury medical support*). [29 CFR 1910.120 (f)].

G. ENTRY OBJECTIVES

The objective of the initial entry into the contaminated area is to (*Describe specific actions and/or tasks to be performed such as conduct initial air monitoring, determine extent of hazards/damage present, conduct origin and cause determination, etc.*).

H. ON-SITE INCIDENT COMMAND ORGANIZATION

The following personnel are designated to perform the stated job functions on-site. (Note: One person may carry out more than one job function).

❑ Incident Commander _____

❑ Safety Officer _____

❑ HAZMAT Duty Officer _____

❑ Operations Section Chief _____

❑ Investigator(s) _____

❑ Supervisor(s) _____

❑ Public Information Officer _____

❑ Police Department Personnel _____

❑ Federal Agency Reps (e.g., BATF, OSHA, EPA, NTSB, etc.) _____

_____

❑ State Agency Reps (e.g., State Fire Marshal, State Police, etc.) _____

❑ Local Agency Reps (e.g., Police Department, etc.) _____

❑ Insurance/Private Investigators _____

NOTE: All personnel arriving or departing the site should log in and out. All activities on-site must be cleared through the Incident Commander.

I. ON-SCENE SECURITY/CONTROL

(*Name of Individual or Agency*)_____
has been designated to coordinate access control and security on-site. A safe perimeter has been established at (*Distance or description of controlled area*).

No unauthorized persons should be within this area. The On-Scene Command Post and Staging Area have been established at

The prevailing wind conditions are _____. This location is located upwind from the Hot Zone. Control boundaries have been established and the Hot Zone (*i.e., Contaminated Area*), Warm Zone (*i.e., DECON Area*), and Cold Zone (*i.e., Clean Area*) have been identified and designated as follows: (*Describe boundaries and/or attach map of controlled area*):

These boundaries are identified by: (*Marking of Zones - Red Boundary Tape (Hot Zone); Traffic Cones (Support Zone), etc.*).

J. PERSONAL PROTECTIVE EQUIPMENT (PPE)

(*Describe the different PPE ensembles / Levels of Protection that will be used to address potential hazards to personnel during site activities (Level A, Level B, Level C, etc.). This description should also include or reference a comprehensive PPE program that addresses site hazards, duration of site activities, limitations of PPE during temperature extremes, PPE selection, maintenance, storage, and decontamination, training for PPE use, inspection and monitoring, and inspection and check-out of self-contained breathing apparatus or other required respiratory protection devices.*

Such PPE should be used only when engineering controls and work practices are insufficient to adequately protect against exposure). [29 CFR 1910.120 (g)].

_____
_____
_____
_____
_____
_____
_____

Based on evaluation of potential hazards, the following levels of personal protection have been designated for the applicable work areas or tasks:

LOCATION	JOB FUNCTION	LEVEL OF PROTECTION
Hot Zone	_____	A B C D Other __
	_____	A B C D Other __
	_____	A B C D Other __
	_____	A B C D Other __
	_____	A B C D Other __
Warm Zone	_____	A B C D Other __
	_____	A B C D Other __
	_____	A B C D Other __
	_____	A B C D Other __
	_____	A B C D Other __

Specific protective equipment for each level of protection is as follows:

LEVEL A Chemical Vapor Tight Suit
Self-Contained Breathing Apparatus (SCBA)

LEVEL B Chemical Splash Clothing
Self Contained Breathing Apparatus (SCBA)

LEVEL C Chemical Splash Clothing
Air Purifying Respirator (APR)

LEVEL D (Description)
(Description)

Other: _____
_____
_____
_____

The following protective clothing materials are required for the substances present on-site:

SUBSTANCE	PROTECTIVE CLOTHING MATERIAL

NOTE: No changes to the specified levels of protection shall be made without the approval of the Site Safety Officer and the Incident Commander.

If air purifying respirators are authorized, (*filtering medium*) _____ is the appropriate canister for use with the involved substances and concentrations. A competent individual has determined that all criteria for using this type of respiratory protection have been satisfied.

K. AIR AND PERSONNEL MONITORING

(*Describe the employee and air monitoring equipment and environmental sampling techniques and instrumentation that will be used on site for evaluating potential exposure to contaminants that result from site activities. The Monitoring Program must include procedures for initial entry monitoring, periodic monitoring, and monitoring of high risk employees*). [29 CFR 1910.120 (h)].

The following environmental monitoring instruments shall be used on-site (cross out if not applicable) at the specified intervals:

• Combustible Gas Indicator	continuous / hourly / daily / other _____
• Oxygen Monitor	continuous / hourly / daily / other _____
• Colorimetric Tubes	continuous / hourly / daily / other _____
_____	continuous / hourly / daily / other _____
_____	continuous / hourly / daily / other _____
_____	continuous / hourly / daily / other _____
• HNU / OVA	continuous / hourly / daily / other _____
Other _____	continuous / hourly / daily / other _____
_____	continuous / hourly / daily / other _____

The following personal monitoring will be in effect at the site:

• **Personal Exposure Sampling**: (*Describe any personal sampling programs being implemented for on-site personnel. This would include the use of sampling pumps, air monitors,etc.*).

• **Medical Monitoring**: The expected air temperature will be (_____^{O}F). If it is determined that heat stress monitoring is required (mandatory if >70^{O}F) the following procedures shall be followed: (*Describe procedures in effect such as monitoring body temperature, body weight, pulse rate, etc.*).

L. SPILL CONTAINMENT PROGRAM

(*Include any elements of the Spill Containment Program that may be relevant to the site, and any procedures to contain and isolate the entire volume of any hazardous substance spilled in the course of transfer, major spill or an on-site release*). [29 CFR 1910.120 (j)].

M. CONFINED SPACE ENTRY PROCEDURES

(*If confined space entry is anticipated on-site, describe procedures for entry into the confined space. Such procedures should ensure the safety of site personnel who must enter areas where natural ventilation is insufficient to reduce contaminant concentrations. Refer to 29 CFR 1910.146, Permit Required Confined Space for additional guidance*). [29 CFR 1910.120 (b)(9)].

N. DECONTAMINATION PROCEDURES

(*Describe appropriate decontamination standard operating procedures for both personnel and equipment on-site and in locations where there is a potential for exposure to a hazardous substance. These procedures should explain how to conduct personal and equipment decontamination when leaving a contaminated area, the recommended levels of protection for personnel involved in decontamination activities, and the proper procedures for disposal of wastes). Refer to NFPA 471, Recommended Practice for Responding to Hazardous Materials Incidents for additional information*). [29 CFR 1910.120 (k)].

Personnel and equipment leaving the Hot Zone shall be thoroughly decontaminated. The site decontamination protocol shall be used with the following decontamination stations:

(1) _____ (2) _____ (3) _____
(4) _____ (5) _____ (6) _____
(7) _____ (8) _____ (9) _____

Other: _____

Emergency Decontamination will include the following stations: _____

The following decontamination equipment is required: _____

(*Normally detergent and water*) _____ will be used as the DECON solution.

NOTES:

O. EMERGENCY RESPONSE PLAN

(*Describe how anticipated emergencies will be handled at the site and how the risks associated with response activities will be minimized. The Emergency Response Plan must be developed and implemented prior to beginning site operations and, at a minimum, should include the following elements: Pre-emergency planning, personnel roles and lines of authority, emergency recognition and prevention, evacuation routes and procedures, emergency contact/notification system, emergency medical treatment procedures, mitigation procedures for fires, explosions, spills or leaks, and emergency equipment/facilities).* _____

P. DOCUMENTATION

All site personnel have read this Plan and are familiar with its provisions.

	Name (Printed)	Signature
Incident Commander	_____	_____
Site Safety Officer	_____	_____
Other Site Personnel	_____	_____

NOTES:

APPENDIX E
PERSONAL PROTECTIVE EQUIPMENT PROGRAM

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INTRODUCTION

Occupational Safety & Health Administration (OSHA) *Hazardous Waste Operations and Emergency Response* regulations (29 CFR 1910.120) require agencies to establish a written Personal Protective Equipment (PPE) program, based on the assumption that PPE is the only protection feasible in dealing with hazardous materials. The amount of protection is dependent upon many factors: selection, fit, work duration conditions, decontamination and human factors. The PPE program is to insure that the level of protection afforded by PPE is sufficient and conclusive for the safety of personnel during hazardous materials operations. Written standard operating procedures governing the selection and use of positive pressure self-contained breathing apparatus (SCBA) are required, as well as maintenance of a respiratory protective program. This program is intended to meet both the PPE and respiratory protective program regulatory requirements.

The Manager / Supervisor / Chief of the Fire / Arson Investigation Unit shall administer the agency's PPE program, in close liaison with a physician responsible for the medical surveillance program. It is OSHA's intention that emergency actions necessary to protect the safety and health of the emergency responder and public be carried out.

PPE shall be provided, used, stored and maintained in accordance with the manufacturer's specifications and recommendations. Recommendations and requirements contained in the National Institute for Occupational Safety and Health (NIOSH) publication, NIOSH Pocket Guide to Chemical Hazards and other applicable reference texts should be used.

Chemical hazards have toxic effects. These effects may be classified as acute and/or chronic. Acute hazards are those capable of producing immediate or delayed effects, such as serious burns, damage to the lungs, or death. Other toxicological effects of chemicals may be delayed or develop only after one exposure or over long periods of time and are referred to as chronic hazards. These effects may involve cumulative damage to many different organs or parts of the body. Carcinogenic effects are usually chronic effects. Although fewer than two dozen chemicals are classified as human carcinogens (i.e., known to cause cancer in humans), several hundred have done so in laboratory animals, and the number of substances suspected to be carcinogenic is growing. The precautions that reduce exposure to acutely hazardous substances should also reduce the probability of chronic effects.

The goal of the (*Insert Name of Organization*) Personal Protective Equipment Program is to protect the health, safety and welfare of all department personnel, and to safeguard others who may be involved in investigative activities at sites where hazardous substances are present. The objective of this program is to provide standard operational guidance to all of these individuals who respond to incidents involving hazardous substances.

This program is available for review and copying by employees and their representatives. Changes to this document will be distributed as "page replacement" changes, along with a cover sheet for filing with the publication. Thus, as the document is updated, obsolete pages will simply be replaced with new pages, or new pages added. This program will be reviewed and updated annually, or as recommended improvements or regulatory provisions dictate.

NOTE: This program is intended to supplement the standard operating procedures contained in the *Hazardous Materials Emergency Response Plan* with respect to personal protective clothing and equipment.

I. SITE HAZARD IDENTIFICATION & ANALYSIS

Selection of personal protective equipment (PPE) is based on information obtained during the site characterization and analysis process. Once an estimate of the types of hazards and their potential concentration has been obtained, proper PPE can be selected. Since all site operating procedures should minimize the possibility of a mishap as a result of existence of a hazard, the hazards must be identified before effective PPE selection can be made.

Air monitoring shall be used to identify airborne levels of hazardous substances and health hazards in order to determine the appropriate level of protection necessary. Upon initial entry, representative air monitoring shall be conducted to identify any dangerous condition such as the presence of flammable atmospheres, oxygen-deficient environments, or toxic atmospheres.

The human sense of smell should never be used to detect odors since it is unreliable. Some gases and vapors, such as fluorine and hydrogen fluoride, are so immediately corrosive and deadly to the upper respiratory tract, that damage is done before odor is detected. Certain gases, such as hydrogen cyanide or hydrogen sulfide may be encountered above permissible safe inhalation limits, and the ability of some to cause olfactory fatigue is well recognized.

At the other end of the scale, carbon monoxide is odorless, and its inhalation can result in fatal consequences. Therefore, odor cannot be utilized to detect the presence of potentially harmful substances. Finally, studies have shown that some persons have extremely high sensitivities, or hypersusceptibility, which may produce serious side effects. The reliable detection and measurement of concentrations of flammable gases is one of the most effective methods of reducing the risk of fires and explosions. All flammable gases have a concentration in air below which they will not ignite in the presence of a competent ignition source called the Lower Explosive Limit (LEL). This concentration is characteristic of an individual gas but the values for most flammable gases fall within the range of 1/2 of 1% to 13% volume in air.

It is generally true that a flammable gas/air mixture is safe as long as the concentration is below the LEL, and thus most flammable gas detectors measure a concentration range up to the LEL of the gas. In effect, flammable gas detectors measure the approach towards a hazardous condition at the monitoring point. But, one should remember that the flammable range LEL/UEL is present somewhere in the incident area.

Flammable vapor detection instruments must be used cautiously. The major problem with flammable vapor detection instruments employing catalytic sensors is the possibility of encountering vapors which will decompose on the catalyst to produce solid products which will cover the catalyst surface and thus render the detecting sensor element inoperable. Vapors which can decompose on the catalyst are those containing silicon, lead and phosphorus. Silicones are widely used in industry potting compounds, greases and polishes. Only a few parts-per-million of silicones are the most potent agents for reducing catalyst activity, but tetraethyl lead in some gasolines and organic phosphorous compounds used as corrosion inhibitors also act to permanently damage the detection element.

Therefore, flammable vapor detection instruments must be calibrated as recommended by the manufacturer to ensure that the detector sensing element is still performing properly, and has not been inadvertently "poisoned" at sometime in the past. For this reason instruments should be calibrated before entry is made, and using appropriate filters. For other than flammable vapors, the most common type of monitoring device utilizes colorimetric indicator tubes, often called detector tubes, in which a hand-pump draws a known volume of atmosphere through a glass tube containing one or more reactive chemicals, usually supported on an adsorption type material such as silica gel.
The product of the reaction between the vapor of interest and the reagent(s) in the tube is colored, and the concentration of the vapor is indicated either by the length of the colored stain or by its depth of color.

Detector tubes can be used to measure a wide range of compounds, both organic and inorganic, with a precision and readability ranging from 30%-50% depending on the reaction principle. They can achieve the same order of accuracy provided interfering gases are absent or can be eliminated. To overcome the interference or "false indication" problem, the manufacturer may incorporate preliminary layers to remove interfering compounds, or will state the effect of any known interfering compounds on a particular test. Therefore, the manufacturer's instructions and guidelines must be followed. All manufacturers calibrate their detector tubes in the factory and normally stamp the boxes with an expiration date giving a shelf life of between one and two years. The tubes must then be discarded since aging of the reactants in the tube will reduce its performance.

Also, since the volume of air drawn through the glass tube is critical for proper measurement, the aspirating hand pump must be checked for leaks before each test to avoid erroneously low results. To check for leaks, an unopened glass tube is inserted into the pump, and a pump stroke is executed. In the case of bellows pumps, it is airtight if the bellows has not expanded again completely after ten minutes. Personnel should not unnecessarily expose themselves to danger during the early phases of major fires and explosions in an attempt to characterize the site. The chemicals involved in various kinds of incidents will mix, explode, burn, yield toxic gases, and even kill, but at some point the entire event will normalize to some degree. While personnel have waited for this state of equilibration that will allow them to safely enter the scene, liquids have fully mixed, soil penetration has become significant, and whatever runoff was possible has occurred.

During the initial phases of fires and explosions, personnel usually cannot perform any significant activities because they may unnecessarily expose people to a high risk of death or injury. The safety afforded by waiting usually far outweighs any gains that can be made by continuing a potentially hazardous operation.

The safety of the personnel who arrive on the scene of an incident involving hazardous substances is critical and must be regarded before any action is taken, since all fire and explosion scenes should be considered extremely hazardous. If the identity of the material(s) involved is not known, individuals should not approach the site before initiating remote attempts to gather more information. The following general safety precautions should be followed:

1. Attempt to approach the site from upwind.
2. If unidentified fuming liquids or gases are present, do not approach.
3. Do not touch any spilled material, and avoid any direct or indirect contact with it.
4. Remove all possible ignition sources, and do not allow smoking.
5. Restrict access to the area.
6. Do not touch any container unless full knowledge of the hazard involved is available.
7. No eating, drinking or smoking is allowed in the hot or warm zones or in prescribed areas until after decontamination.

Periodic air monitoring shall be conducted when the possibility of an IDLH condition or flammable atmosphere has developed or when there is an indication that exposures may have risen over permissible exposure limits or published exposure levels since prior monitoring.

Situations where it shall be considered whether the possibility that exposure levels have risen are as follows:

1. When work begins on a different portion of the site.
2. When contaminants other than those previously identified are being handled.
3. When a different type of operation is initiated (e.g. drum opening as opposed to exploratory well drilling).
4. When employees are handling leaking drums or containers or working in areas with obvious liquid contamination (e.g. a spill or lagoon).

In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary site operational objective shall be to prevent atmospheric contamination. When other controls are not feasible, or while they are being instituted, appropriate SCBA/positive pressure shall be used according to the requirements of this program.

In analyzing the site to determine PPE requirements, it should be remembered that where feasible, first choice should be given to eliminating the hazardous environment. Analysis of site hazards is necessary to protect the health of individuals, and positive pressure SCBA shall be provided.

II. PERSONAL PROTECTIVE EQUIPMENT SELECTION

Personal protective equipment shall be selected to meet the requirements of 29 CFR Part 1910, Subpart I, and the additional requirements specified in this program. An appropriate combination of engineering controls, work practices, and PPE shall be established to reduce and maintain exposure to or below appropriate exposure levels for hazardous substances and health hazards, taking into account established exposure levels. Positive pressure SCBA should be considered the minimum level of respiratory protection at incidents determined to contain IDLH atmospheres where the potential for exposure to hazardous substances (i.e., flammable, toxic, corrosive, asphyxiants) exists.

PPE selection shall be based on an evaluation of the performance characteristics of the PPE relative to the requirements and limitations of the site, the task-specific conditions and duration, and the hazards and potential hazards identified at the site. **The primary consideration for selection of PPE, tools, equipment and materials is that they must be compatible with the particular hazardous materials(s) confirmed to be present at the site.**

Only non-sparking tools should be used whenever flammable materials are involved. Also, because of the potential fire/explosion hazard, all equipment and devices (pumps, machinery, instruments and detectors) that will be

operated at the scene must be of a design which is safe to operate in the presence of flammable vapors, and should be intrinsically safe for Class I Division I atmospheres.

A description of the levels of PPE and discussion of hazard criteria is contained in the *Hazardous Materials Emergency Response Plan*, Appendix A, describing Levels A, B, C and D. This guidance is taken directly from 29 CFR Section 1910.120, which is based on U.S. Environmental Protection Agency standard operating procedures for hazardous waste sites.

Different types of respirators provide different degrees of protection from contaminants, and each type has been assigned Protection Factors (PF). The formula for calculation of the PF is:

$$\text{Protection factor (PF)} = \frac{\text{ambient air concentration}}{\text{concentration inside facepiece}}$$

The SCBA operated in the positive pressure mode has been tested on a selected 31-man panel and the facepiece leakage recorded as less than 0.01% penetration. Therefore, a PF of 10,000+ is recommended. A positive pressure SCBA for an unknown concentration is recommended.

Multiplying the permissible time weighted average concentration or the permissible ceiling concentration, whichever is applicable, for a toxic substance, or the maximum permissible airborne concentration for a radionuclide by the protection factor assigned to the respirator gives the maximum concentration of the hazardous substance for which the respirator can be used.

Respirators and clothing shall be selected and used in accordance with the selection criteria contained in NIOSH Pocket Guide to Chemical Hazards, which shall be consulted as the definitive source document for PPE questions. Permissible Exposure Limit criteria shall be selected from the most restrictive of OSHA regulations or NIOSH recommendations if both are listed. Recommendations of the American Conference of Government Industrial Hygienists (ACGIH) are not mandatory.

Recommended practices listed under the "Personal Protection and Sanitation" column of the Chemical Listing portion, as explained in Table 2, shall be followed. The column of "Measurement Method" recommendations contained in the NIOSH Pocket Guide to Chemical Hazards are not mandatory, since they do not recognize approved instruments and methodology developed by U.S. EPA subsequent to the compilation of the data in the Guide. Data contained in Guidelines for the Selection of Chemical Protective Clothing, 3rd Edition, U.S. Environmental Protection Agency, 1987, is valuable in assessing which chemical protective clothing material is most suitable for various chemical exposures. Instructions for utilization of this complex document are contained on pages 64 & 65, Volume I, of the guide..

The state-of-the-art approach for selecting PPE is to initially assume the worst exposure condition and use the highest level of PPE. Then, as the chemical and physical agents present are characterized, the PPE can be selected to match specific hazards. Common practice is to then use the minimum amount of PPE as necessary to provide protection. PPE can be burdensome and restrictive; minimizing PPE increases the likelihood that it will be worn and minimizes the loss in efficiency that typically accompanies PPE utilization.

Helmets for the protection of the head of individuals from impact and penetration from falling and flying objects shall meet the requirements and specifications established in *American National Standard Requirements for Protective Headwear for Industrial Workers*, Z89.1-1981.

Safety-toe footwear for individuals shall meet the requirements and specifications in *American National Standard for Men's Safety-Toe Footwear*, Z41.1-1967.

III. PERSONAL PROTECTIVE EQUIPMENT USE

Personal protective equipment shall be used to meet the requirements of 29 CFR Part 1910, *Subpart I-Personal Protective Equipment, Subpart Z-Toxic and Hazardous Substances*, and the additional requirements specified in this program. PPE shall be used which will protect individuals from the hazards and potential hazards they are likely to encounter as identified during the site characterization. Individuals shall use the provided respiratory protection in accordance with instructions and training received. Positive pressure self-contained breathing apparatus, or positive pressure air-line respirators equipped with an escape air supply, shall be used in IDLH conditions. Individuals shall be instructed and trained in the proper use of respirators and their limitations. Totally-encapsulating chemical protective suits shall be used in conditions where skin absorption of a hazardous substance may result in an IDLH situation.

Compressed air used for respiration shall be of high purity. Breathing air shall meet at least the requirements of the specification for Grade D breathing air as described in Compressed Gas Association (CGA) Commodity Specification for Air, G-7.1-1973. Breathing air may be supplied to respirators from cylinders or air compressor. When self-contained breathing apparatus are used in atmospheres immediately dangerous to life or health, standby personnel must be present with suitable rescue equipment. PPE shall be used in accordance with the OSHA and NIOSH requirements and recommendations of the NIOSH Pocket Guide to Chemical Hazards, which shall be mandatory.

IV. WORK MISSION DURATION

The work mission to be accomplished shall be scheduled and conducted in accordance with all procedures established in this program, and the department's *Hazardous Materials Emergency Response Plan*. The capabilities and limitations of PPE must be considered in all work mission planning and execution. The basic limitation of SCBAs is the length of time that each of these devices can be used. This is limited by the air supply that the wearer can carry. SCBA are assigned nominal ratings for the length of time they would protect the average person doing moderately heavy work.

It must be emphasized that these ratings serve only as a guide and that the air supply can be consumed more rapidly in a stress situation. Therefore, SCBA are provided with a warning device (e.g., a bell or other audible warning) that indicates when the remaining service life has been reduced to the point that the wearer should return to an uncontaminated atmosphere. Further limitations on the use of SCBAs may be attributed to their size and weight, especially for work in confined spaces. Continuing supervision and observation must be maintained during all times the work mission is being accomplished in PPE. If at any time during conduct of the work mission an individual is found to be unqualified, unsuitable, or incapable, the hazardous work shall be stopped. **Any individual whose behavior or emotional instability presents a potential hazard should not be permitted to continue to participate in any hazardous duties. The task shall continue only as long as it can be conducted according to the procedures developed and approved for that particular operation**.

During the conduct of the work mission, individuals must be instructed to promptly report any unusual condition which could place them in further jeopardy, such as discovery of an unanticipated dangerous substance, unsafe condition, or malfunction of any PPE or safety device. No person shall be allowed alone in a hazardous location, unless that person's location and condition are closely monitored. All involved individuals shall insure that the mission is halted if any operation is found which might result in injury to other personnel who might be present in the area due to incompatibilities of their tasks.

V. PERSONAL PROTECTIVE EQUIPMENT MAINTENANCE AND STORAGE

A maintenance and care program for respirators shall be adjusted to the location, working conditions, and hazards involved. Respirators shall be regularly cleaned and disinfected. Those used by more than one individual shall be thoroughly cleaned and disinfected after each use. Respirators shall be stored in a convenient, clean, and sanitary location. Equipment shall be properly maintained to retain its original effectiveness. Respirators shall be thoroughly inspected at least daily by the users, once a month for stored units, and routinely before and after each use, to insure they are in satisfactory working condition.

Worn or deteriorated parts shall be replaced. Respiratory protection is no better than the respirator in use, even though it is worn conscientiously. Frequent random inspections shall be conducted by a qualified individual to assure that respirators are properly selected, used, cleaned, and maintained.

Air cylinders shall be fully charged according to the manufacturer's instructions. It shall be determined that the regulator and warning devices function properly. Cylinders shall be tested and maintained as prescribed in the regulations of the U.S. Department of Transportation. Respirator inspection shall include a check of the tightness of connections and the condition of the facepiece, headbands, valves, connecting tube, and cartridges for puncture or blockage; similarly, air supply system hose lines should not be punctured or blocked. In addition, the regulator and any warning devices on self-contained breathing apparatus (SCBA) should also be examined to ensure that they function properly. Rubber or elastomer parts shall be inspected for pliability and signs of deterioration. Stretching and manipulating rubber or elastomer parts with a massaging action will keep them pliable and flexible and prevent them from taking a set during storage. A record shall be kept of inspection dates and findings for respirators. Disassembly for cleaning provides a good opportunity to inspect each component of the device for flaws. Because respirators that are taken apart might be reassembled improperly, an inspection should be performed after the cleaning process.

Replacement or repairs shall be done only by experienced persons with parts designed for the respirator. No attempt shall be made to replace components or to make adjustments or repairs beyond the manufacturer's recommendations. Reducing or admission valves or regulators shall be returned to the manufacturer or to a trained technician for adjustment or repair. Once repaired, inspection and testing should be conducted to insure that the repair was adequate.

After inspection, cleaning and necessary repair, respirators shall be stored to protect against dust, sunlight, heat, extreme cold, excessive moisture or damaging chemicals. Dust and excessive moisture may collect and accumulate in chemical cartridges causing damage and reducing the filtering capacity of the cartridge. In order to avoid any of these storage problems, each cleaned respirator should be placed in a closed container and stored in a clean, dry area away from direct sunlight and heat. Respirators should be packed or stored so that the facepiece and exhalation valve will rest in a normal position and function will not be impaired by the elastomer setting in an abnormal position. Instructions for proper storage of emergency respirators, such as self-contained breathing apparatus, are found in "use and care" instructions usually mounted inside the carrying case lid.

VI. PERSONAL PROTECTIVE EQUIPMENT DECONTAMINATION

A decontamination procedure shall be developed, communicated to all individuals and implemented before anyone enters locations where the potential for exposure to hazardous substances exists. All PPE removed from a contaminated area shall be appropriately disposed of or decontaminated. Decontamination procedures shall be monitored by the Safety Officer to determine their effectiveness. When such procedures are found to be ineffective, immediate steps shall be taken to correct any deficiencies.

PPE shall be decontaminated, cleaned, laundered, maintained or replaced as needed to maintain their effectiveness. Recommendations contained in the "Personal Protection and Sanitation" column of the Chemical Listings, NIOSH Pocket Guide to Chemical Hazards shall be followed, as well as the manufacturer's guidelines. Non-impermeable PPE clothing which becomes wetted with hazardous substances will be disposed of or decontaminated before it is removed from the site. When in doubt, throw it out. Commercial laundries or cleaning establishments that decontaminate PPE shall be informed of the substances so they may take necessary precautions and decontaminate clothing appropriately.

VII. PERSONAL PROTECTIVE EQUIPMENT TRAINING AND PROPER FITTING

To properly select, use and maintain personal protective equipment, all individuals should be properly trained. As a minimum, the PPE training program will include the following steps:

1. Instruction in the types, nature ,extent and effects of hazards likely to be encountered, and a discussion of what can happen if the proper PPE is not used.

2. Discussion of the different types of PPE and how they are selected.

3. Discussion of PPE functions, capabilities and limitations.
4. Instruction and training in actual use and proper wearing of PPE.
5. Close supervision to ensure that the PPE continues to be used properly.
6. Classroom and field training to recognize and cope with emergency situations.
7. The actual PPE and detection instruments employed in the field to insure proficiency.
8. Instructions in the engineering and administrative controls being used, an explanation of why engineering controls are not adequate, the reasons for the need for respirators to provide protection, and what efforts are being made to reduce the need for respirators.
9. Providing the reason(s) for selecting particular types of PPE.
10. Method of donning PPE and checking its fit and operation.
11. How to recognize and cope with emergency situations.
12. Regulations concerning respirator use.
13. Adjusting the respirator so as to cause a minimum of discomfort.

For safe use of any respirator, it is essential that the user be properly instructed. Both supervisors and subordinates shall be so instructed by competent persons. Training shall provide an opportunity to handle the respirator, have it fitted properly, test its face-piece-to-face seal, wear it in normal air for a long familiarity period, and, finally, to wear it in a test atmosphere. Each respirator wearer shall be retrained at least annually, in accordance with OSHA 29 CFR 1910.134.

Every respirator wearer shall receive fitting instructions including demonstrations and practice in how the respirator should be worn, how to adjust it, and how to determine if it fits properly. Respirators shall not be worn when conditions prevent a good face seal. Such conditions may be a growth of beard, sideburns, a skull cap that projects under the facepiece, or temple pieces on glasses. A respirator equipped with a facepiece shall not be worn if facial hair comes between the sealing periphery of the facepiece and the face, or if facial hair interferes with valve function. Also, the absence of one or both dentures can seriously affect the fit of a facepiece. To ensure proper protection, the facepiece fit shall be checked by the wearer each time he puts on the respirator. This may be done by following the manufacturer's facepiece fitting instructions.

Respirator fit can be assessed by quantitative and qualitative methods. Quantitative fit tests involve placing an individual wearing the respirator in a chamber containing a non-toxic gas, vapor, or aerosol (i.e., a tracer compound). The air inside the respirator is then monitored for the presence of the tracer by means of analytical instrumentation. Although very effective, quantitative methods are usually restricted to laboratory settings. Qualitative fit testing does not require sophisticated or expensive equipment, and can easily be performed in the field. Such testing typically consists of two procedures:

1. Negative pressure test; and
2. Positive pressure test.

In the negative pressure test, all air entry ways to the respirator are closed off. This can be accomplished by squeezing the breathing tube. The wearer then inhales slowly thereby causing the facepiece to collapse slightly. Upon the collapse of the facepiece, the wearer stops inhaling for at least 10 seconds while observing the facepiece. If the facepiece remains collapsed and no leakage is evident, it is likely that the respirator fit is acceptable. The positive pressure test is the converse of the above test. In this test the exhalation valve is closed off with a palm of a hand and the wearer gently exhales. An increase in pressure within the facepiece should be felt.

Respirator fit testing should be performed upon issue of the device to each individual and periodically thereafter to ensure continued proper fit and performance of the respirator. A respirator fitting test shall be carried out at least annually. During the fitting test, the wearer shall carry out a series of exercises which simulate work movements for at least two minutes. The exercises should include normal and deep breathing, turning the head from side to side and up and down, and talking.

The series of exercises for testing respirators in conjunction with a suit include but are not limited to the following:

1. Standing still, arms hanging down, normal breathing;

2. Bending forward and touching toes, and squatting;
3. Raising arms above head and looking up, and

4. Running in place.

Providing respiratory protection for individuals wearing corrective glasses is a serious problem. A proper seal cannot be established if the temple bars of eye glasses extend through the sealing edge of the full facepiece. As a temporary measure, glasses with short temple bars or without temple bars may be taped to the wearer's head. The wearer of a respirator equipped with a full facepiece or suit shall not be allowed to wear contact lenses. Systems have been developed for mounting corrective lenses inside full facepieces. When the individual must wear corrective lenses as part of the facepiece, the facepiece and lenses shall be fitted by qualified individuals to provide good vision, comfort, and a gas-tight seal. If corrective spectacles or goggles are required, or the helmet is worn, they shall be worn so as not to affect the fit of the facepiece. Proper selection of equipment will minimize or avoid this problem.

Records of respirator fitting tests shall be kept at least the duration of employment. These records shall include the following information:

1. Type of respirator fitting test used.
2. Specific make and model of respirator tested.
3. Name of person tested.
4. Name of test operator.
5. Date of test.
6. Results of respirator fitting tests.

VIII. PERSONAL PROTECTIVE EQUIPMENT DONNING AND DOFFING PROCEDURES

At the time of use, each wearer should inspect the PPE prior to donning (wearing) it. The objective is to identify tears, punctures, fabrication flaws or functional problems that could compromise the protection anticipated from the PPE. Prior to donning, inspect the item for defects such as imperfect seams, non-uniform coatings, pinholes, malfunctioning closures, and tears. Some flexible materials may stiffen during extended storage periods; flex the item and check for surface cracks or other signs of shelf-life deterioration. Pinholes may be detected by holding the garment up to a light in a darkened area. Full-body encapsulating ensembles should be checked for the operation of pressure-relief valves and the fittings at the wrists, ankles, and neck.

Holes in gloves can be identified by pressurizing the glove. This can be accomplished by blowing into the glove and then tightly rolling the gauntlet towards the fingers (thereby reducing volume and increasing pressure) while observing that the glove holds pressure. Alternatively, the glove could be inflated and then held under water and examined for the presence of air bubbles, or water may be used to fill the glove. A post-donning inspection is essential for full-body encapsulating suits. This may be best carried out with the assistance of a second individual who is able to check closures and interconnections between, for example, gloves and sleeves, boots and pants, etc. Further reinspections should be performed throughout the work period, especially if the wearer has experienced significant contact with a chemical or suspects the integrity of the PPE may have been breached.

During use, inspections should concentrate on checking for tears, punctures, seam discontinuities, or closure failure which developed while working. Evidence of chemical attack such as discoloration, swelling, stiffening, or softening should also be noted. Any item of clothing that has been physically damaged or chemically degraded should be removed and replaced as soon as safely possible. Following completion of the work, PPE is removed (doffed). A primary consideration in doffing is to avoid transfer of chemical that may be on the outside of the PPE to clean areas, skin, underclothing. It is common practice to doff PPE in designated areas, in many cases following a preliminary decontamination. Doffing procedures will be accomplished in accordance with the decontamination protocols established in this program.

IX. PERSONAL PROTECTIVE EQUIPMENT INSPECTION

New PPE shall be inspected on receipt to ensure that all required safety features and devices have been incorporated or provided.
Any deviation from OSHA standards, procedures considered safe, or any obvious safety deficiencies should be corrected before the equipment is accepted. The review should ensure that the existence of any possible hazard has actually been avoided or eliminated to the greatest degree practicable. Appropriate safeguards should have been established for any hazard that could not be eliminated.

In addition to the inspections prescribed throughout this program, personal protective equipment shall be periodically inspected. Respirator inspection shall be at least once a month, and shall include:

1. The connections.
2. The facepiece shape--it should not be bent or malformed in any way.
3. The head straps, which should not be stretched out or loose.
4. The inhalation valve.
5. The air-purifying cartridges for puncture or blockage or the air supply hose lines for puncture or blockage.
6. The regulator and warning device on SCBA for proper function.

Periodic inspection of personal protective clothing shall include:

1. The entire garment for tears, punctures or fabrication flaws.
2. The seams for closure failure or bonding separation.
3. Closures and interconnections for condition.
4. Facepieces for crazing, deterioration or bonding failure.
5. Any evidence of chaffing, thinning or damage from storage.
6. Any evidence of improper decontamination or damage from a previous use.
7. Proper repacking for storage.

Detection and warning equipment utilized to insure the continued adequacy of PPE must be maintained in a state in which operations and readings are dependable and accurate. To do this, they must be periodically inspected, tested and calibrated as indicated by the manufacturer's recommended inspection procedures. Only personnel properly trained and qualified to inspect, calibrate and adjust such equipment shall be assigned to perform these duties. PPE and detection and warning equipment which is found to have defects shall be either discarded or repaired. Once repaired, inspection and testing should be conducted to assure that the repair was adequate.

X. PERSONAL PROTECTIVE EQUIPMENT IN-USE MONITORING

Any piece of equipment must be operated within the limitations under which it was designed. The Safety Officer will monitor the use of PPE to insure that it is being utilized in accordance with its capabilities, design parameters and any requirements or recommendations contained in the NIOSH Pocket Guide to Chemical Hazards. The Safety Officer will further monitor PPE use to ensure that it is approved and suitable for the specific hazards to be encountered. No operation should be continued unless PPE and instruments and devices are in proper working order and used as stipulated.

The Safety Officer shall ensure that personnel are physically and psychologically prepared to continue to properly utilize their PPE in performance of their duties. When there is any doubt regarding whether the limitations of a person involving PPE might be exceeded, especially when a hazardous operation is involved, medical advice should be requested. Undue exposure of personnel to physiological, psychological or physical stresses should be avoided when utilizing PPE.

PPE decontamination procedures shall be monitored by the Safety Officer to determine their effectiveness. When such procedures are found to be ineffective, appropriate steps shall be taken to correct any deficiencies. PPE shall be decontaminated, cleaned, laundered, maintained or replaced as needed to maintain their effectiveness.

When winds, meteorological or other conditions are observed which could affect the performance of PPE or individuals, or conditions change which could adversely affect PPE, the Safety Officer must be notified. Operating procedures should specify actions that personnel should take when failure of any PPE is detected.
No person shall use poorly fitted or defective PPE, remove the equipment while in the hazardous environment, or remain in the hazard area if the PPE is damaged or faulty. If control of the hazard is lost, all individuals must be informed immediately.

Whenever PPE is being utilized, the buddy system must be used, and constant communications maintained between the persons involved. A person in a hazardous situation must remain within sight of his buddy at all times or otherwise remain in communication to indicate well-being. Non-impermeable PPE clothing which becomes wetted

with hazardous substances shall be immediately removed. The clothing shall be disposed of or decontaminated before it is removed from the site.

Monitoring devices should be available to detect, warn, and protect against an impending or existing dangerous condition. Such equipment should be used to evaluate atmospheres that might be toxic, flammable, or explosive or in which excessive levels of radiation, heat, pressure, noise, or other hazard might exist and to appraise personnel of the status of such conditions or when control of the hazard is lost. Detection and warning equipment will be operated and adjusted only by those personnel trained and assigned for that purpose.

Monitoring shall be performed to assure proper selection of PPE so that individuals are not exposed to levels which exceed permissible exposure limits for hazardous substances.

XI. EVALUATION OF PERSONAL PROTECTIVE EQUIPMENT PROGRAM EFFECTIVENESS

There shall be regular inspection and evaluation to determine the continued effectiveness of this program. Personnel must be encouraged to report PPE, monitoring devices or controls which adversely affect their performance. Program improvements and elimination of deficiencies cannot be effective unless the program is monitored and evaluated on a continuing basis. Results of the evaluation of the program will be made available to all affected individuals, and presented to top management of the department so that program adaptations may be made as needed.

Elements of the periodic review and evaluation include:

1. The number of person-hours in various protective ensembles;
2. Accident-illness experience;
3. Levels of exposure;
4. Appropriateness of equipment selection;
5. Adequacy of operational guidelines;
6. Adequacy of decontamination, cleaning, inspection, maintenance and storage problems;
7. Adequacy and effectiveness of training and fitting programs;
8. Coordination with overall safety and health program elements;
9. Costs of the program;
10. The degree of fulfillment of program objectives;
11. The adequacy of program records; and,
12. Recommendations for program improvement and modification.

An appraisal of the effectiveness of the PPE program shall be carried out at least annually. Action shall be taken to correct defects found in the program. The evaluation findings shall be documented, and shall list plans to correct faults in the program and target dates for implementation.

The following techniques may be used in evaluating the effectiveness of a respirator program:

1. Wearer acceptance: The effectiveness of a respiratory protection program can be largely determined by the degree of user acceptance. Numerous factors affect the wearer's acceptance of respirators. These include comfort, ability to breathe without objectionable effort, adequate visibility under all conditions, provisions for wearing prescription glasses if necessary, ability to communicate, ability to perform all tasks without undue interference, and the facepiece fit. How well these problems are resolved can be determined by observing wearers during normal activities and by soliciting their comments.

2. Evaluation of respirators in use: Frequent random inspections are conducted to assure that respirators are properly used, cleaned, and maintained.

3. Evaluation of protection afforded: Biological testing and the periodic physical examinations provide a basis for medical evaluation of the effectiveness of the respirators.

If normal operational scenarios change, the program will be updated to reflect these changes. Proper selection, use and care of PPE for hazardous materials incidents is essential to the health and safety of response individuals. Failure to follow established procedures, to choose the correct PPE, or improper use and care can easily result in

serious injury or death. The simplest way to find out if the PPE program is being effective is to ask the individuals involved in doing the work. The *Critical Incident Technique* represents a means found effective in traditional industrial safety management programs, and is explained below.

The *Critical Incident Technique* consists of interviewing personnel regarding their involvement in accidents or near accidents; difficulties, errors, and mistakes in operations; and conditions that could cause mishaps. The interviewer requests the person interviewed to include their own experiences and also experiences of other personnel which they have actually observed. The person is asked to describe all near-misses or critical mishaps that can be recalled. A professional safety engineer states, "Studies have shown that people are more willing to talk about 'close calls' than about injurious accidents in which they were personally involved, the implication being that if no loss ensued, no blame for the accident would be forthcoming."

In effect, the *Critical Incident Technique* accomplishes the same result as an accident investigation: identification through personal involvement of a hazard that has or could result in injury or damage. It has been estimated that for every mishap there are at least 400 near-misses. When the witnesses who observed a mishap or near-miss, but were not participants, are added to those who were involved, an extremely large population is available from which information on possible accident causes can be derived. Even isolated incidents reported by the technique can be investigated to determine whether corrective action is necessary or advantageous. When a group of persons is interviewed regarding similar types of equipment or operations, similarities begin to appear concerning hazards and near-misses. Where these indicate deficiencies, difficulties, or other inadequacies, they can be accepted as indicators of areas in which improvements are necessary.

Attempts have been made to produce similar effective results in obtaining safety information through the use of surveys to be filled-in by selected personnel. This method has proved to be unsatisfactory for a number of reasons. One fundamental problem was the need for extreme care in selecting and phrasing the questions. Too often, the person completing a questionnaire would give the questions interpretations neither considered nor intended by the person who prepared them. Much information is also submitted in the form of after-action reports or incident report "packages." However, this reporting itself generates discrepancies that can be avoided by using the critical incident technique. Reports usually require entries in narrative form or in enclosed checklists, or both. Personnel find it time-consuming and frequently difficult to prepare a complete narrative. Even conscientious report writers tend to select the easiest and most rapid means of accomplishing them.

Reports are therefore usually lacking in detail and precision that could indicate the source of the problem. Formats requiring checking-off items can be done much more rapidly, but these too result in omissions of information that may be critical. In both types, entries may include information on the immediate or principal cause of an incident, but other contributory causes and factors may be neglected. Personnel need to be constantly looking for those situations, jobs or procedures which increase the likelihood of making a safety-related mistake.

Some of the characteristics that can increase the probability of human error are those which:

1. Violate operator expectations
2. Require performance beyond what an operator can deliver
3. Induce fatigue
4. Provide inadequate facilities or information for the operator
5. Are unnecessarily difficult or unpleasant
6. Are unnecessarily dangerous

Recent safety theory disputes the traditional "domino" theory of accident causation, and replaces it with a multiple-causation theory. The multiple causation theory states that accidents are caused by the combination of a number of things, all wrong, which combine at one point in time and result in injury. This theory suggests that the act, the condition and the accident itself are all symptoms of something wrong in the management system. The role of safety is not to remove the symptom, but to find out what is wrong with the system. Unit supervisors need to look at things such as management policy, employee training, supervisor training, supervisory accountability, inspection procedures and practices, to ensure the accident will not happen again.

Safety rules are codes of conduct to avoid injury and damage, but unless they are observed and enforced, they are useless. Individuals who fail to properly observe designated safety procedures are guilty of willfully or perhaps even negligently introducing unsafe practices which could harm others.

XII. LIMITATIONS DURING TEMPERATURE EXTREMES AND OTHER MEDICAL ASPECTS

Appropriate surveillance of work area conditions and degree of individual exposure or stress shall be maintained by the Safety Officer. Individuals should not be assigned to tasks requiring use of respirators unless it has been determined that they are physically able to perform the work and use the equipment. A medical surveillance program physician shall determine what health and physical conditions are pertinent. The individual's medical status will be reviewed annually, as part of the department's medical surveillance program, and a biological monitoring program is established to determine exposure to hazardous materials.

Biological monitoring is a preventive medical tool within the medical surveillance program that is used to discern the human toxicity of potential toxicants at exposure levels present at the site. Evidence of human toxicity can result from individual hypersusceptibility, inadequate exposure limits which might have been derived from animal data, or unsuspected large increases in site contamination. Biological monitoring tests are among the most valuable medical surveillance tools, in that reliable and valid biological tests can be a positive indication of exposure to a harmful material. Biologocal tests may also be used to screen for the hypersusceptible worker represent an important preventive aspect of the medical surveillance program. The development of sensitive and specific biological markers of early medical evidence of specific exposures holds promise to allow the identification of inadequate exposure containment and unsafe exposure limits before irreversible impairment of health has occurred.

Unfortunately, relevant toxicological information on metabolism and mechanism of action for many industrial chemicals is lacking, and thus no biologic method can yet be proposed. Furthermore, even if preliminary investigations suggest the usefulness of a biological monitoring method, quite often no meaningful biologic limit value can yet be proposed because clinical studies are insufficient to elaborate the dose-response curves. However, a total of sixty-nine chemicals have been identified for which analytical methodology is considered to be sufficiently well validated for application in worker surveillance programs.

When specific biological measurements are feasible, the approach offers important advantages over monitoring the air at the site. The two main advantages are:

1. It takes into consideration absorption by all the routes, not only through the lungs; and

2. It may consider individual differences in the sensitivity to the chemical or differences in its rate of absorption, distribution, biotransformation, and excretion.

Each individual is thus his own integrator of the total exposure. Since there are dozens of hazardous materials for which biological monitoring may be useful, it is self-evident that the control of chemical exposure risks cannot wait until epidemiological studies have defined the no-adverse-effect level directly in man. The advisability of biological monitoring at any time a question arises as to exposure shall always be positively considered. Specifically recommended biological monitoring tests shall be determined by the physician administering the department's medical surveillance program. When the exposure conditions stated for the administration of a test occur, i.e., exposure to a cholinesterase-inhibiting pesticide, the appropriate biological monitoring test, in this instance blood cholinesterase activity, shall be accomplished at the earliest available opportunity. Results of the tests shall be forwarded to the physician for his interpretation.

Other factors have been found which complicate the understanding of chemical absorption and action in man. The interaction between chemical exposures and factors within the total living environment can have a profound effect on the observed toxic response. The relationship between alcohol consumption and work place exposure has been well documented. A summary of information linking habitual tobacco smoking and industrial exposure with increased health problems exists. The synergistic effects of tobacco smoke with substances such as cadmium, chloromethyl ether, and aromatic amines have also been reported.

In high temperatures, heat stress has been found to adversely affect operations. Heat stress represents an imbalance between the heat produced by an individual and the heat loss allowed to the environment. The latter is as frequently controlled by the clothing worn as by any combination of environmental conditions; there is no single temperature or combination of temperature and humidity at which heat stress can be said to begin. Heat stress has occurred in men working very hard in the snow, although it is usually not recognized as such.

There are a great number of complex equations dealing with heat stress and temperature conditions, however, they typically involve such a number of variables as to be difficult to apply in the field without special measuring instruments or equipment. However, a general set of guidelines has been developed for moderate work rates in impermeable protective clothing based upon six U.S. and foreign studies:

AMBIENT AIR TEMPERATURE DEGREES F	WEARING TIME
30 degrees or less	8 hours
30-50 degrees	5 hours
50-60 degrees	3 hours
60-70 degrees	2 hours
70-80 degrees	90 minutes
80-85 degrees	60 minutes
85-90 degrees	30 minutes
90 degrees or above	15 minutes

Extensive data from studies also indicates that at high temperatures, work time should be limited to 15 minutes, followed by 45 minutes rest. Field tests conducted by the Phoenix Fire Department monitoring deep-body temperatures during summer-time work indicate that during high heat, a maximum of two, 15-minute work periods should be allowed in any 8-hour work shift in impermeable protective clothing. Older individuals tend to have reduced heat tolerance to work, exhibit higher heart rates and slightly higher deep-body temperatures, and take longer to return to normal body temperatures. Thus they will not be able to work as long or hard in high temperatures.

A number of studies on work performance and heat conditions have confirmed the importance of the following guidelines:

1. Drink 1 quart of water in the morning, at each meal, and before any hard work.
2. Take frequent drinks, since they are more effective than all at once. Larger workers need more water.
3. Replace salt loss by eating 3 meals per day.
4. As the temperature increases, rest periods must be more frequent, work rate lowered, and loads reduced.
5. Use water as a key element to maintain top efficiency by drinking each hour.
6. Individuals given access to unlimited water will still dehydrate and experience degraded performance. Therefore, there must be a conscious program to force workers to drink adequate water.

A physician shall determine what physiological and psychological conditions are pertinent for the wearing of different types of respirators. The physician shall determine whether or not a person may be assigned to a task requiring the use of a respirator. This determination shall be reviewed at least annually.

A physician shall determine if a person should or should not wear a respirator if the person has any of the following:

1. Emphysema.
2. Chronic obstructive pulmonary disease.
3. Bronchial asthma.
4. X-ray evidence of pneumoconiosis.
5. Evidence of reduced pulmonary function.
6. Coronary artery disease or cerebral blood vessel disease.
7. Severe or progressive hypertension.
8. Epilepsy, grand mal or petit mal.
9. Anemia, pernicious.
10. Diabetes, insipidus or mellitus.
11. Punctured eardrum.
12. Pneumomediastinum gap.
13. Communication of sinus through upper jaw to oral cavity.
14. Breathing difficulty when wearing a respirator.
15. Claustrophobia or anxiety when wearing a respirator.

The importance of claustrophobia, anxiety, and other psychological factors should not be overlooked. Persons psychologically unsuited to wearing respirators may be in situations in which they become a danger to themselves and others. Therefore, respirator users must show evidence that the wearing of respiratory protection will not produce undue physical or psychological stress or risk. The complex psychological (stress) factors which may be present in incidents involving hazardous materials are not well understood.

Noise is generally defined as "unwanted sound," and criteria for acceptability of noise are determined by the effects produced. Major areas of emergency response-related concern are hearing damage resulting from exposure to excessive noise, and speech interference or interruption of communication by noise. At this time, the only apparent significant medically-related concern with noise is hearing loss caused by excessive noise. It should be noted, however, that there is data showing that under continuous, 100-db noise conditions, performance of tasks requiring vigilance made more errors than workers performing under quieter conditions. However, repeated excessive noise can transform this temporary loss into a permanent condition which is irreversible, cannot be corrected or restored by surgical or medical means, and is permanent in nature.

OSHA permissible noise exposure levels are related to sound level over a period of time, with the loudest acceptable exposure of 115 dBA permissible for less than 15 minutes per day. At this time, it appears the only potential exposure at this level which could be encountered during a hazardous material emergency response would be generated from a hole saw used to drill an overturned cargo tank. No data is yet available for this activity, but if it proves to be in the excessive range, a program will be initiated involving ear protection devices of either the ear plug or earmuff type to reduce the penetration of the sound from the outer to the inner ear to acceptable levels.

XIII. REFERENCES

This Personal Protective Equipment Program was written based on the requirements for *a Personal Protective Equipment Program* contained in OSHA's *Hazardous Waste Operations and Emergency Response Rule*, 29 CFR Section 1910.120. The program's organizational elements are as prescribed in these regulations. Primary content was then derived from further regulatory provisions contained in 29 CFR Section 1910.120, 29 CFR *1910 Subpart I-Personal Protective Equipment*, and 29 CFR 1910 *Subpart Z-Toxic and Hazardous Substances*.

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APPENDIX F
INITIAL FUNCTIONS

F.1: If investigators arrive on the scene prior to the arrival and stabilization of the incident by fire department personnel, action should be avoided until the potential safety and/or health hazards are known. If the material(s) / substances(s) cannot be identified and/or personnel cannot perform control action safely:

1. Isolate immediate area.
2. Maintain perimeter security / control.
3. Await arrival of Hazardous Materials Response Team (HMRT) or other technical specialists (e.g., industry product specialists).
4. Limit the number of non-essential personnel entering the scene.

F.2: First arriving units will begin to size-up and consciously avoid committing to any potentially dangerous situation. When approaching, slow down or stop to assess any visible activity taking place.

F.3: **REMEMBER, QUICK AGGRESSIVE ACTION HAS NO PLACE AT A HAZARDOUS MATERIALS INCIDENT**, and may only lead to unnecessary exposure of personnel. Often times the proper action decided upon may be to take NO ACTION beyond keeping department and civilian personnel at a safe distance. There may be situations where NO ACTION will be the only safe action for first arriving units to take because of lack of proper protective clothing.

F.4: There are certain functions which the first responder must accomplish at the scene of the release of known or suspected hazardous materials. The first arriving unit(s) shall:

1. Approach the incident location from upwind and uphill.

2. Position vehicle back from the incident location.

3. Avoid entering or close approach to any vapors or smoke.

4. Consider all unidentified containers or released products (including smoke) as a hazardous material until identified as non-hazardous.

5. Assess the incident from a distance.

6. Identify the type of incident:

    a. Hazardous material release with fire.
    b. Hazardous material release with no fire.
    c. Hazardous material involved, no release apparent, with fire.
    d. Hazardous material involved, no release apparent, no fire.

7. Advise the Communications Center and other responding units of type of incident and appropriate response entry route or location of staging area.

8. Identify or categorize released product if safe to do so:

    a. Visual observations.
    b. Verbal information.
    c. Placards, labels and/or shipping papers.

9. Obtain as much information regarding the incident as possible.

10. Notify the Communications Center of the situation and product involved.

11. Utilize the **North American Emergency Response Guidebook** for recommended actions.

12. Request indicated assistance:

    a. Fire department units.
    b. Hazardous Materials Unit (automatically dispatched on Level II and Level III incidents).
    c. Additional law enforcement:
        (1) Traffic control
        (2) Perimeter control
        (3) Evacuation

    d. Technical support:
        (1) Department technical advisors
        (2) Poison Control Center
        (3) Ambulance
        (4) Monitoring equipment

13. Protection measures:

    a. Personnel upwind/uphill
    b. Vehicle upwind/uphill
    c. Distance
    d. Avoid contact with released product
    e. Avoid action until product identified and hazards known

14. Site Management: Rescue, Isolate, Control, Exposures (RICE):

    a. Rescue:
        (1) If immediate rescue is indicated, perform only with awareness of hazard and minimum number of personnel required. Avoid as much personal contact as possible.
        (2) Rescue should only be attempted when risk to personnel is known. Use caution, do not become a casualty yourself.
        (3) When the hazard is unknown, rescue should not be initiated until the Hazardous Materials Response Team has assessed the situation.

    b. Isolate immediate release area. Establish incident control zones. (Hot and warm zones).
        (1) Evacuate as necessary. Based on past experiences, evacuation distances up to 2,000 feet in every direction should be considered. (NORTH AMERICANEMERGENCY RESPONSE GUIDEBOOK evacuation distances shall be used, if available).
        (2) Isolation and evacuation should be accomplished in increments. Heating, ventilating and air conditioning systems in exposed buildings may need to be shut down. Consider movement of people in exposed buildings to the far side of the building and then evacuate.
        (3) Deny entry to people/vehicles.
    c. Control:
        (1) Confine/contain product to as small an area as possible.
        (2) Prevent container failure.
    d. Exposures:
        (1) Protect exposures.
        (2) Attempt to extinguish fires if appropriate and safe.
        (3) Contain contaminated runoff if practical.
        (4) Prevent hazardous and toxic materials from entering sewers, etc.

APPENDIX G
DEFINITION OF TERMS

Buddy system: A system of organizing employees into work groups in such a manner that each employee of the work group is designated to be observed by at least one other employee in the work group. The purpose of the buddy system is to provide rapid assistance to employees in the event of an emergency.

Cold zone: The cold zone of a hazardous materials incident that contains the command post and such other support functions as are deemed necessary to control the incident. This zone is also referred to as the "Clean Zone" or "Support Zone" in other documents.

Command Post: A stationary position designated by the Incident Commander where coordination and control of manpower and equipment takes place.

Contaminant: A hazardous material that physically remains in or on people, animals, the environment, or equipment, thereby creating a continuing risk of direct injury or a risk of exposure outside of the hot zone.

Contamination: The process of transferring a hazardous material from its source to people, animals, the environment or equipment, which may act as a carrier.

Contamination Reduction Corridor: This area is usually located within the warm zone and is where decontamination procedures take place. This is also referred to as the decontamination area in other documents.

Control zones: The designation of areas at hazardous materials incidents based upon safety and the degree of hazard, usually verified through air monitoring. These zones are typically referred to as the "HOT", "WARM", and "COLD" zones.

Decontamination (contamination reduction): The physical or chemical processes of reducing and preventing the spread of contamination from persons and equipment used at a hazardous materials incident.

Emergency Decontamination: The physical process of immediately reducing contamination of individuals in potentially life-threatening situations without the formal establishment of a contamination reduction corridor.

Emergency Response Plan: A plan that establishes guidelines for handling hazardous materials incidents as required by 29 CFR 1910.120.

Environmental hazard: A condition capable of posing an unreasonable risk to air, water, or soil quality, and to plants or wildlife.

Established exposure levels: The inhalation or dermal permissible exposure limit specified in 29 CFR Part 1910, Subpart Z; or if none is specified, the exposure limits in "NIOSH Recommendations for Occupational Health Standards" dated 1986, or if neither of the above is specified, the standards specified by the American Conference of Governmental Industrial Hygienists in their publication "Threshold Limit Values and Biological Exposure Indices for 1986-87" dated 1986.

Exposure: The process by which people, animals, the environment, and equipment are subjected to or come in contact with a hazardous material. The magnitude of exposure is dependent primarily upon the duration of exposure and the concentration of the hazardous material. Also used to describe a person, animal, the environment or a piece of equipment.

First Responder-Awareness Level: Individuals who are likely to witness or discover a hazardous substance release and who have been trained to initiate an emergency response sequence by notifying the authorities of the release.

First Responder-Operations Level: Individuals who respond to releases or potential releases of hazardous substances as part of the initial response to the site for the purpose of protecting nearby persons, property, or the environment from the effects of the release.

They are trained to respond in a defensive fashion without actually trying to stop the release. Their function is to contain the release from a safe distance, keep it from spreading, and prevent exposures.

Full protective clothing: Protection to prevent gases, vapors, liquids and solids from coming in contact with the skin. Full protective clothing includes the helmet, self-contained breathing apparatus, coat and pants customarily worn by fire fighters (turn-out or bunker coat and pants), rubber boots, gloves, bands around legs, arms and waist, and face mask, as well as covering for neck, ears and other parts of the head not protected by the helmet, breathing apparatus or face mask.

Hazard/hazardous: Capable of posing an unreasonable risk to health and safety or the environment; capable of causing harm.

Hazardous material: (Includes hazardous substance) - A substance (i.e., solid, liquid or gas) that when released, is capable of creating harm to people, the environment and property.

Hazardous Materials Response Team: An organized group of trained response personnel operating under an emergency response plan and appropriate standard operating procedures, who are expected to perform work to handle and control actual or potential leaks or spills of hazardous materials requiring possible close approach to the material. The team members perform response to releases or potential releases of hazardous materials for the purpose of control or stabilization of the incident.

Hazardous Materials Technician: Individuals who respond to releases or potential releases for the purpose of stopping the release. They assume a more aggressive role than a first responder at the operations level in that they will approach the point of release in order to plug, patch or otherwise stop the release of a hazardous substance.

Hot zone: An area immediately surrounding a hazardous materials incident, which extends far enough to prevent adverse effects from hazardous materials releases to personnel outside the zone. This zone is also referred to as the exclusion zone or the restricted zone in other documents.

IDLH or **Immediately Dangerous to Life or Health:** An atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere.

Incident: The release or potential release of a hazardous material, with or without fire.

Incident (On-Scene) Commander: The Incident Commander is the local person responsible for all decisions relating to the management of the incident. The Incident Commander is in charge of the incident site.

Mitigation: Actions taken to prevent or reduce product loss, property damage, human injury or death, and environmental damage due to the release or potential release of hazardous materials.

Monitoring equipment: Instruments and devices used to identify and quantify contaminants in order to determine the level of personal protection needed.

Overpack: An enclosure that is used to consolidate two or more packages.

Oxygen deficiency: That concentration of oxygen by volume below which atmosphere supplying respiratory protection must be provided. It exists in atmospheres where the percentage of oxygen by volume is less than 19.5 percent oxygen.

Permissible exposure limit: Means the exposure, inhalation or dermal permissible exposure limit specified in 29 CFR Part 1910, Subparts G & Z.

Protective Clothing: Equipment designed to protect the wearer from heat and/or hazardous materials contacting the skin or eyes. Protective clothing is divided into four types:

a. Structural fire fighting protective clothing

b. Liquid splash protective clothing
c. Vapor protective clothing
d. High temperature protective clothing

Protective clothing material: Any material or combination of materials used in an item of clothing for the purpose of isolating parts of the body from direct contact with a potentially hazardous liquid or gaseous chemicals.

Published exposure level: The exposure limits published in "NIOSH Recommendations for Occupational Health Standards" dated 1986 incorporated by reference, or if none is specified, the exposure limits published in the standards specified by the American Conference of Governmental Industrial Hygienists in their publication *Threshold Limit Values and Biological Exposure Indices.*

Qualified person: A person with specific training, knowledge and experience in the area for which the person has responsibility and the authority to control that has satisfactorily completed the learning objectives for a particular subject.

Response: That portion of incident management in which personnel are involved in controlling (defensively or offensively) a hazardous materials incident. The activities in the response portion of a hazardous materials incident include analyzing an incident, planning the response, implementing the planned response, and evaluating progress.

Safety Officer or site safety and health supervisor (or official): The individual located on a hazardous waste site who is responsible to the employer and has the authority and knowledge necessary to implement the site safety and health plan and verify compliance with applicable safety and health requirements.

Safety team: The rescue or backup team for personnel working in the hot zone which visually monitors operating personnel. Protected at the same level of protection as the team(s) working in the hot zone.

Sampling: Sampling is the process of collecting a representative amount of air, water, soil, product, chemical or hazardous material for analytical purposes.

SCBA: Self-contained breathing apparatus.

Senior official: The most senior official on the site who has the responsibility for controlling the operations at the site.

Skilled Support Personnel: Personnel, not necessarily an employer's own employees, who are skilled in the operation of certain equipment, such as mechanized earth moving or digging equipment, or crane and hoisting equipment, and who are needed temporarily to perform immediate emergency support work that cannot reasonably be performed in a timely fashion by an employer's own employees, and who will be or may be exposed to the hazards at an emergency response scene.

Specialist Employees: Employees, who in the course of their regular job duties, work with or are trained in the hazards of specific hazardous substances, and who will be called upon to provide technical advice or assistance at a hazardous substance release incident to the individual in charge.

Stabilization: The stage of an incident in which the adverse behavior of the hazardous material is controlled.

Staging area: Always located in the cold zone. The outermost area of the incident and is considered a non-contaminated or clean area. It is designated as a controlled traffic area for authorized support personnel and the location for support equipment and the Command Post. Since normal work clothes are the appropriate apparel within this zone, potentially contaminated personal clothing, equipment, etc., are not permitted.

Totally encapsulating chemical protective suit: A full body garment that is constructed of protective clothing materials; covers the wearer's torso, head, arms, and legs; may cover the wearer's hands and feet with tightly attached gloves and boots; completely encloses the wearer by itself or in combination with the wearer's respiratory equipment, gloves and boots.

Warm (decontamination) zone: The control zone at a hazardous materials incident site where personnel and equipment decontamination and hot zone support takes place. It includes control points for the access corridor, helping to reduce the spread of contamination. This zone is also referred to as the decontamination, contamination reduction, or limited access zone in other documents.