



# **HAZARDOUS MATERIALS OPERATING GUIDE**

SAN FRANCISCO FIRE DEPARTMENT

Some useful emergency phone numbers

**Local**

Battalion Two Cell Phone	1-415-699-7602
Hazardous Materials Unit Cell Phone	1-415-990-3548
DPH Emergency Responder Pager	1-415-252-3855
Wastewater Treatment Plant Chief Operator	1-415-648-6882 ext. 1257

**National**

Center for Disease Control	1-404-633-5313
CHEMTREC	1-800-424-9300
DOT Trans shipment Information	1-202-462-9280
Institute Maker's of Explosives	1-212-689-3237
Oil Spills	1-800-852-7550
Pesticides	1-513-961-4300
Poison Control Center	1-800-523-2222
24 Hour CAS Number Information	1-800-848-3747

Hazardous Materials Operations Guide  
January 2008  
San Francisco Fire Department  
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San Francisco, CA 94107

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Division of Training  
2310 Folsom Street  
San Francisco, CA  
Phone: (415) 970-2000

REVISED: January 2008  
This manual is the sole property of the San Francisco Fire Department

## FOREWORD

The goal of this manual is to establish standard operating practices as authorized by the Chief of Department and implemented by the Division of Training.

The purpose of this manual is to provide all members with the essential information necessary to fulfill the duties of their positions, and to provide a standard text whereby company officers can:

- Enforce standard drill guidelines authorized as a basis of operation for all companies.
- Align company drills to standards as adopted by the Division of Training.
- Maintain a high degree of proficiency, both personally and among their subordinates.

All manuals shall be kept up to date so that all officers may use the material contained in the various manuals to meet the requirements of their responsibility.

Conditions will develop in fire fighting situations where standard methods of operation will not be applicable. Therefore, nothing contained in these manuals shall be interpreted as an obstacle to the experience, initiative, and ingenuity of officers in overcoming the complexities that exist under actual fire ground conditions.

To maintain the intent of standard guidelines and practices, no correction, modification, expansion, or other revision of this manual shall be made unless authorized by the Chief of Department. Suggestions for correction, modification or expansion of this manual shall be submitted to the Division of Training. Suggestions will be given due consideration, and if adopted, notice of their adoption and copies of the changes made will be made available to all members by the Division of Training.

Joanne Hayes-White  
Chief of Department

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## INTRODUCTION

Safety is a serious business; treat it as such. As emergency responders, it is even more important to consider the safety aspects of each activity you perform. When chemicals are unexpectedly released from their containers, the rules change.

During chemical spill situations, it is important to work safely, wear the proper protection, and develop an attitude that questions every decision you make

- What action must be taken immediately?
- Is evacuation necessary?
- Can the product be contained or controlled?
- Are additional personnel needed at the scene?
- Should technical assistance be summoned?
- Is the command post in the proper location?
- Could this operation be done more safely?
- What are the long-term effects of exposure?

In many cases, reliable documentation on the health effects of the materials involved is not available. We must protect ourselves today against what may be discovered tomorrow. All contact that would allow any hazardous material to be introduced into the body through ingestion, inhalation, or skin absorption must be avoided.

Emergency responders with limited immediate resources and limited knowledge of chemicals should avoid becoming actively involved with chemicals that have been inadvertently released from their containers. Operations should be limited to isolation, scene security, and evacuation.

Rescue and control operations should only be performed when the emergency responders can do so safely and without unnecessarily exposing themselves. Remember that the most important persons at an emergency are the first responders. Without them, the incident may progress uncontrolled in an unfavorable direction.

Incidents involving the release of hazardous materials have increased considerably in recent years. These incidents differ from other emergencies because of the wide range of causative factors and the pervasiveness of potential threats.

Because the role of the fire service is one of life and property protection, the fire service will be called to incidents involving hazardous materials. When these incidents occur, it is important to become part of the solution, not part of the problem.

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 Guidelines (SOGs). The purpose

## SECTION 1. SCENE MANAGEMENT

of this guide is to develop some standard operating guidelines and responsibilities for emergency response personnel when responding to hazardous materials incidents.

Proper utilization of Standard Operating Guidelines and COMMON SENSE can help prevent a hazardous material incident from becoming a hazardous materials emergency.

The advantages of Standard Operating Guidelines include:

- Improves coordination
- Simplifies training
- Insures adequate protection of personnel
- Provides consistency
- Serves as reference guide
- Reduces time in problem solving
- Allows coordination with other agencies and departments

For the purpose of this guide, hazardous material means:

"A substance or combination of substances, that because of quantity, concentration, physical, chemical or infectious characteristics, may either cause or contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness, or pose a present or potential hazard to human life, property or the environment."

In this guide, a hazardous material spill or incident is an occurrence where a hazardous material has dispersed into the environment, or its container is damaged to such an extent that a threatened release of the contents can be expected, with the potential to cause injury to people and/or harm to property or the environment.

Hazardous material incident control, like fire fighting, requires latitude in the decision making process. This guide attempts to complement that process, not inhibit it. For organizational purposes, compliance with the law, and for safety while working at hazardous material incidents, personnel should attempt to meet the intent of this guide as much as possible.

## SECTION 1. SCENE MANAGEMENT

Scene management at hazardous materials incidents is a critically important function, to ensure the effective use of personnel and for coordinating activities of other agencies.

Scene management includes coordinating multi-agency response and proper actions, and ensuring that appropriate resources are applied in a timely manner. The San Francisco Fire Department is responsible for scene management of hazardous materials incidents within the limits of the City and County of San Francisco, except for the freeways where the managerial functions are assigned to the California Highway Patrol.

When incidents occur on freeways, CalTrans is responsible for identification, containment, cleanup, salvage and disposal of materials spilled within the State highway right of way. When hazardous materials are involved, CalTrans will secure the specialized services of private industry to do scene restoration. CalTrans shall be promptly notified of any hazardous material or suspected hazardous material incident affecting, or which may be expected to affect, a State highway or freeway.

The following paragraphs are excerpts from 29 Code of Federal Regulations (CFR), Section 1910.120, and apply to scene management:

The senior emergency response official responding to an emergency shall become the individual in charge of a site specific Incident Command System (ICS). All emergency responders and their communications shall be coordinated and controlled through the individual in charge of the ICS assisted by the senior official present for each employer.

Note: The senior official at an emergency response is the most senior official on the site who has the responsibility for controlling the operations at the site. Initially it is the senior officer on the first due piece of responding emergency apparatus to 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 which has been previously established. As the response grows and other agencies outside of San Francisco respond, the Standardized Emergency Management System (SEMS) and the National Incident Management System (NIMS) requirements will become applicable.

## SECTION 1. SCENE MANAGEMENT

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

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

Employees engaged in emergency response and exposed to hazardous substances presenting an inhalation hazard or potential inhalation hazard shall wear positive pressure self contained breathing apparatus while engaged in emergency response until such time that the individual in charge of the ICS determines through the use of air monitoring that a decreased level of respiratory protection will not result in hazardous exposures to employees.

The individual in charge of the ICS shall limit the number of emergency response personnel at the emergency site, in those areas of potential or actual exposure to incident or site hazards, to those who are actively performing emergency operations. However, operations in hazardous areas shall be performed using the buddy system in groups of two or more.

Back up personnel shall stand by with equipment ready to provide assistance or rescue. Advance first aid support personnel, as a minimum, shall also stand by with medical equipment and transportation capability.

## **INCIDENT STAGES**

The San Francisco Fire Department is responsible for first response to incidents involving hazardous materials during both the critical and containment stages, with technical support from the San Francisco Department of Public Health (SFDPH).

The Hazardous Materials Team (HazMat Team) shall provide technical expertise, equipment, and assistance at the incident and shall perform duties as directed by the Incident Commander (IC).



The shipper, spiller, or owner is responsible for the recovery and cleanup stage of the incident. The Department of Public Health shall have final responsibility for declaring an area "safe" or "clean" when toxic products have been released.

The Department of Public Works (DPW) shall assist in mitigating the spread of the spill or discharge. Public Utilities Commission (PUC) System Planning, Environment, and Compliance (SPEAC) will provide pathways to the water pollution control plant if the spill/discharge should enter the City's combined sewerage system. After arrival at the scene, PUC SPEAC will assume responsibility for the collection and subsequent analysis of samples according to established Environmental Protection Agency (EPA) protocol.

### **Critical Stage**

The first few minutes after arrival of first responders to an incident scene involving hazardous materials is the critical stage. A first responder is the first arriving organized responder to arrive at the site of a hazardous materials incident with governmental authority to assess and initiate scene control.

Identification of the materials involved and stabilization of an incident are primary goals of first responders. Their actions, more than any others, can affect the severity of the incident.

Identification of the materials involved can be done remotely by identifying placards, labels, or other markings on containers, or by talking to drivers or facility personnel. Shipping papers carried by transporters or inventory control sheets at facilities will help in identifying the materials involved. Container shapes may help in identifying some hazards involved. Vapors, smoke, and other visual indicators such as bubbling are indicators of the presence of hazardous materials.

There is a severe danger to first responders who are unprotected when they approach the scene to identify the materials involved. Necessary steps to insure adequate protection for personnel include the establishment of a "safe" perimeter, procedures for entering the incident site, and proper protective clothing.

Stabilization of the incident can be accomplished by confining the material to as small an area as possible. Stabilization of an incident involves:

- Isolating the area
- Protecting people, structures, or other substances from contact or interaction with the material
- Controlling factors such as injuries, traffic, downed power lines, etc.
- Confining the product
- Mitigating entry of spill/discharge into the City's combined sewage system, as is practical.

### **Containment Stage**

Once an incident involving hazardous materials has been stabilized, efforts must be directed toward ending the discharge or release of hazardous materials. Often, stabilization of the incident is most readily achieved by ending the discharge.

The Department of Public Works will provide assistance in the containment of the spill/discharge with the use of sand, absorbents, barricades, dump trucks, and other heavy equipment.

Termination of discharge includes:

- Repositioning an overturned/spilling container
- Plugging a leak
- Closing a valve
- Pumping a leaking container's contents into another container (off loading)
- Placing a leaking container into an overpack container

### **Recovery Stage**

Recovery and cleanup is the final stage of the incident. As the shipper, spiller, or owner is responsible for recovery and cleanup, San Francisco Fire Department personnel will only participate in this stage with permission of the Incident Commander and when extenuating circumstances exist.

It is important for the Incident Commander to identify responsible parties in hazardous materials releases. The responsible party can then do the necessary cleanup operations or request private cleanup contractors.

Department personnel shall not directly contact cleanup/disposal agencies. The responsible party should be informed that they are financially responsible for the cleanup/disposal of hazardous materials and that they should contact a cleanup/disposal company.

When the responsible party cannot be identified, or has been identified but is unable to have cleanup done in a reasonable time and the incident has occurred in a critical public area, assistance from the Department of Public Health and the Department of Public Works shall be requested.

When the responsible party is not available, and the use of private contractors for cleanup is considered by the Incident Commander, the request shall be made through the DPH Emergency Responder, as the Department of Public Health has existing contracts for cleanup contractors.

In addition, the DPH representative may contact the Duty Officer of the California Office of Emergency Services. They, in turn, will contact the Duty Officer of the State of California EPA. The duty officer may approve funding and assign a State hazardous waste contractor to remove the hazardous waste.

## **ACTIVATION**

Emergency response to a hazardous material incident is activated upon receipt of notification by the San Francisco Fire Department of any oil, fuel, chemical, nuclear, biological, or other hazardous material spill or release that occurs within the jurisdiction of the City and County of San Francisco, including those portions of the San Francisco Bay within the City limits. These areas include the Golden Gate National Recreation Area in the Presidio and Treasure Island.

The Department of Public Health (DPH) Environmental Health Services shall be notified by the Communications Center anytime the HazMat Team is dispatched to a hazardous materials incident. The DPH shall make the necessary notifications required under State law (Prop. 65).

For incidents that may involve hazardous waste violations with the possible identification of the responsible party, the DPH Emergency Responder will contact a representative of the San Francisco Environmental Crimes Unit.

Sealed abandoned containers of hazardous waste or hazardous materials that are not leaking are normally a non-emergency situation, and should not require a hazardous materials emergency response by the Fire Department's HazMat Team. However, if samples are needed for possible criminal prosecution, Hazardous Waste Enforcement personnel, DPH Emergency Responders, and/or the San Francisco Environmental Crimes Unit may request the Fire Department's HazMat Team personnel to obtain samples for evidence.

For non-emergency issues dealing with hazardous waste or hazardous materials, the Department of Public Health responder should be contacted at 252-3855. Whenever doubt exists as to the danger of the material or container involved, the HazMat Team shall be notified in order to obtain additional information and assistance.

Anytime the HazMat Team is dispatched to a hazardous materials incident or major fire that may adversely impact the City's combined sewage system or other public property, the DPH's Emergency Responder shall contact the Wastewater Treatment Plant Chief Operator.

## INCIDENT CLASSIFICATION AND RESPONSE

For suspected hazardous materials incidents, the Communications Center will dispatch a battalion chief and an engine company. An incident involving motor fuel leaking from the fuel tank of a vehicle will normally not require the response of a battalion chief. For incidents reported by knowledgeable sources (police, facility representatives, etc.), the Communications Center will dispatch resources (as indicated below) according to the severity of the incident.

The Incident Commander shall decide the level of the incident, and as a minimum, shall request the equipment and assistance described below.

**ANYTIME THE HAZARDOUS MATERIALS UNIT IS DISPATCHED TO AN INCIDENT INVOLVING HAZARDOUS MATERIALS, THE DEPARTMENT OF PUBLIC HEALTH'S ON-CALL EMERGENCY RESPONDER SHALL BE NOTIFIED BY THE COMMUNICATIONS CENTER.**

Hazardous materials incidents are divided into Levels I, II, and III. In ascending order of severity, these levels are:

### Level I

**Definition:** A Level I incident is a minor incident within the capabilities of the Fire Department. A Level I incident is defined as a release of less than 5 gallons liquid or less than 20 pounds solid of a known hazardous material. At a minimum, a Hot Zone and a Command Post must be established. A Hot Zone is the area of maximum hazard and is restricted to personnel wearing the proper level of protection.

**Response:** For reported incidents meeting the Level I definition, the Communications Center will dispatch a battalion chief, an engine company, and the HazMat Team (Battalion 2, the HazMat Unit, one Medic Unit, and the Department of Public Health emergency responder). When only a battalion chief and an engine company were initially dispatched to a suspected hazardous materials incident, the Incident Commander shall request the HazMat Team whenever hazardous materials are confirmed and additional expertise or equipment is required to protect persons or the environment.

**Level II.**

**Definition:** A Level II incident is a major incident that poses many additional problems for the first responders and may require assistance from other City and County agencies. A Level II incident is defined as the release of 5 gallons or more liquid or 20 pounds or more solid of a known hazardous material, the release of any quantity of a known gaseous toxic material, 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, a staging area, and incident control zones (including a decontamination corridor) must be established and maintained. Localized evacuation may be required.

**Response:** For reported incidents meeting the Level II definition, the Communications Center will dispatch a battalion chief, an engine company, the HazMat Team (Battalion 2, the HazMat Unit, one rescue squad, one Medic Unit, and the DPH Emergency Responder). When only a battalion chief and an engine company were dispatched, the Incident Commander shall request the HazMat Team (units as indicated above).

**Level III**

**Definition:** A Level III incident is 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.

**Response:** For Level II and III incidents involving hazardous materials, a staging area for apparatus 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 Level II and III incidents should be advised of the staging area location, the appropriate entry route, and directed to report to the staging area.

Equipment and personnel already on scene should be moved to the staging area, if not already committed, needed, or contaminated. During this phase of the incident, the staging area may be used as the base for coordinating localized emergency operations. The staging area also serves as a rally point for aid coming into an incident site and for post disaster support and recovery activities.

For reported incidents meeting the Level III definition, the

## SECTION 1. SCENE MANAGEMENT

Communications Center will dispatch a full first alarm assignment, the HazMat Team (Battalion 2, the HazMat Unit, both rescue squads, three Medic units, Rescue Captain 3, the SFFD Safety Officer, and the DPH Emergency Responder), and the Hazardous Materials/MMRS Support Unit. When only a battalion chief and an engine company were dispatched for a suspected hazardous materials incident and the incident meets the definition of a Level III incident, the Incident Commander shall request a full first alarm assignment including the HazMat Team (units as indicated above), and the Hazardous Materials Support Unit.

**NOTE: THE MAKE-UP OF THE HAZMAT TEAM CHANGES DEPENDING ON THE SIZE AND COMPLEXITY OF THE SITUATION**

Additional equipment and supplies are available from the SFFD Warehouse and the Department of Public Works. Battalion 2 has access to the SFFD Warehouse 24 hours a day through the key box outside of the warehouse. Requests shall be made through the Communications Center. Equipment and supplies include: additional personal protective equipment, decontamination equipment, drums, sand, absorbents, barricades, dump trucks and other heavy equipment.

Mutual aid response will be made according to existing agreements with neighbor communities and only upon authorization of the Chief of Department.

Many outside agencies may be needed to provide assistance and support. These agencies might include: HazMat Units in San Mateo County and other nearby jurisdictions; chemical manufacturers; Red Cross; Salvation Army; US Coast Guard; Environmental Protection Agency; Federal Emergency Management Agency; California State Office of Emergency Services; California National Guard; 95th Civil Support Team; City and County Office of Emergency Services; and many other City and County Departments.

### **INCIDENT CONTROL ZONES**

The purpose of setting up Incident Control Zones at hazardous material incidents is to: secure the scene, establish perimeters, maintain safe and efficient control over operating personnel, and to prevent people, vehicles, and resource equipment from entering a dangerous situation.

A hazardous material incident scene may be divided into three separate zones: HOT (Exclusion), WARM (Buffer), and COLD (Safe or Support). The Hot Zone denotes the area of maximum hazard, the Warm Zone surrounds and includes the Hot Zone, and the Cold Zone is the safe area beyond the boundaries of the Warm Zone.

A wide range of variables influences the size and shape of the incident control zones:

- Physical and chemical properties
- Quantities of the hazardous material
- Size, shape, and condition of the container
- Dispersion patterns of the material
- Existing and anticipated weather and wind conditions
- Geographic features surrounding the incident
- The presence of other potentially involved materials

Incident Control zones should be established by the Incident Commander when possible, using all available technical information (guides and reference manuals) and advice from the HazMat Team.

Minor incidents may only require a small Hot Zone with traffic cones and firefighters maintaining security. But, if conditions change, the Incident Commander 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 irregularly shaped zones.

### **Hot Zone (Also Called Exclusion Zone)**

The Hot Zone is the area of maximum hazard and must be restricted to essential personnel wearing the proper protective clothing and having a specific activity. Access to the Hot Zone should be controlled by the Fire Department, Police Dept., and/or Sheriff's Dept, with entry exit restricted to one location. Only personnel or teams requested by the Hazardous Materials Group Supervisor shall enter the Hot Zone. Command of the Hot Zone shall stay with the Hazardous Materials Group Supervisor throughout the incident. The HazMat team Battalion Chief from Battalion 2 normally fills the HMGS position.

Personnel entering the Hot Zone should be kept to the minimum required to perform the assigned task, but never less than two persons, as operations in the Hot Zone shall be done using the buddy system in groups of two or more operating as a team.

All withdrawals from the Hot Zone must take place through the Decontamination Corridor. When a team enters the Hot Zone to do stabilization operations, a Back-Up Team will be suited up and be available to help.

A Hot Line separates the Hot Zone from the Warm Zone. The Hot Line is the inner perimeter of the Warm Zone. Ideally, the Hot Line should be identified using red "Hazardous Materials Do Not Enter" tape. Other available devices such as traffic cones or natural or man made barricades (ditches, roads, fences, etc.) also may be used. The Hot Line should be easily recognized and strictly enforced by the Site Access Control Leader.

### **Warm Zone (Also Called Decontamination Reduction Zone Or Buffer Zone)**

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 required for the Hot Zone.

Within this Warm Zone, the relief, support, and security personnel, the Back-Up Team, technical advisors, and decontamination equipment are all assembled to support those working in the Hot Zone. All unauthorized personnel should be withdrawn from this area, and only essential personnel should remain. As in the Hot Zone, entry into the Warm Zone should be restricted to just one location.

A Decontamination Corridor should be established within the Warm Zone, with entry at the Hot Line from the Hot Zone. The extent of decontamination required 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 and equipment in the Decontamination Corridor.

All equipment removed from the Hot Zone should be decontaminated or packaged and properly disposed of. Where possible, a check will be done (such as checking pH, level of radiation, etc.) to verify the effectiveness of decontamination. Disposal of equipment requires approval of the Chief of Department or a Deputy Chief.

The Safe Refuge Area is a designated area in the Hot Zone, near the decontamination corridor where victims, who have not yet gone through final decontamination, can assemble. The HazMat Group Supervisor may designate authorized personnel with personal protective equipment to perform medical treatment or triage in this area.

The outer perimeter of the Warm Zone should be appropriately marked. Ropes or traffic cones may be used, but are not as effective as the yellow warning tape. This perimeter is called the Contamination Control Line. The Hazardous Materials Unit will usually be located in the Warm Zone. The Site Access Control Leader will control access to the Hot and Warm Zones.

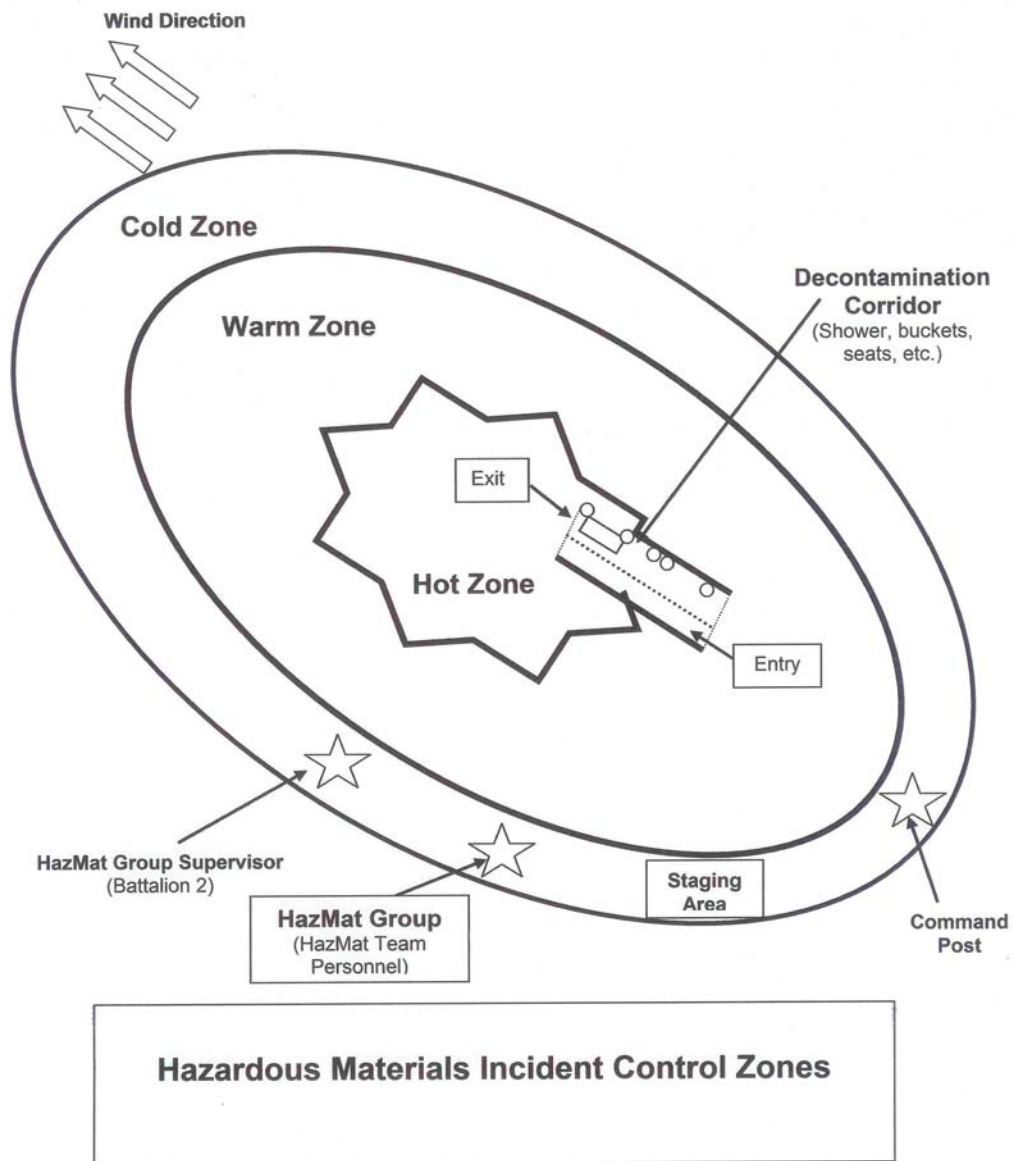
### **Cold Zone (Also Called Support Zone)**

The Cold Zone is the safe area beyond the outer perimeter of the Warm Zone. Although the Cold Zone is considered safe, and the movement of persons is unrestricted, in 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. In the event circumstances change, due to an escalation of events or a change in environmental conditions occurs (such as an increase in wind, or a change in wind direction) the public will remain safe.



An escape route from the Hot and Warm Zones shall be identified and kept open for emergency evacuation of personnel and equipment and the removal of injured civilians or personnel. Emergency response vehicles should be parked in a direction pointed away from the Hot Zone, when feasible. This will allow a quicker “escape”, if needed.

Control zones can provide an organized system that will help the Incident Commander in properly ending hazardous materials incidents while maximizing protection of emergency response personnel and civilians.



## HAZARDOUS MATERIALS INCIDENT COMMAND STRUCTURE

The Hazardous Materials Group Supervisor (Battalion 2) reports to the Incident Commander or Operations Section Chief, if assigned. He or she is responsible for the implementation of the phases of the Incident Action Plan dealing with the Hazardous Materials Group operations. In addition, the Hazardous Materials Group Supervisor (Battalion 2) is responsible for the assignment of resources within the Hazardous Material Group, reporting on the progress of control operations and the status of resources within the Group, as well as directing the overall operations of the Hazardous Material Group.

The Entry Leader (HazMat Officer) reports to the Hazardous Materials Group Supervisor. The Entry Leader is responsible for the overall entry operations of assigned personnel within the Hot Zone.

The Decontamination Leader reports to the Hazardous Materials Group Supervisor. The Decontamination Leader is responsible for the operations of the decontamination element providing decontamination as required by the Incident Action Plan.

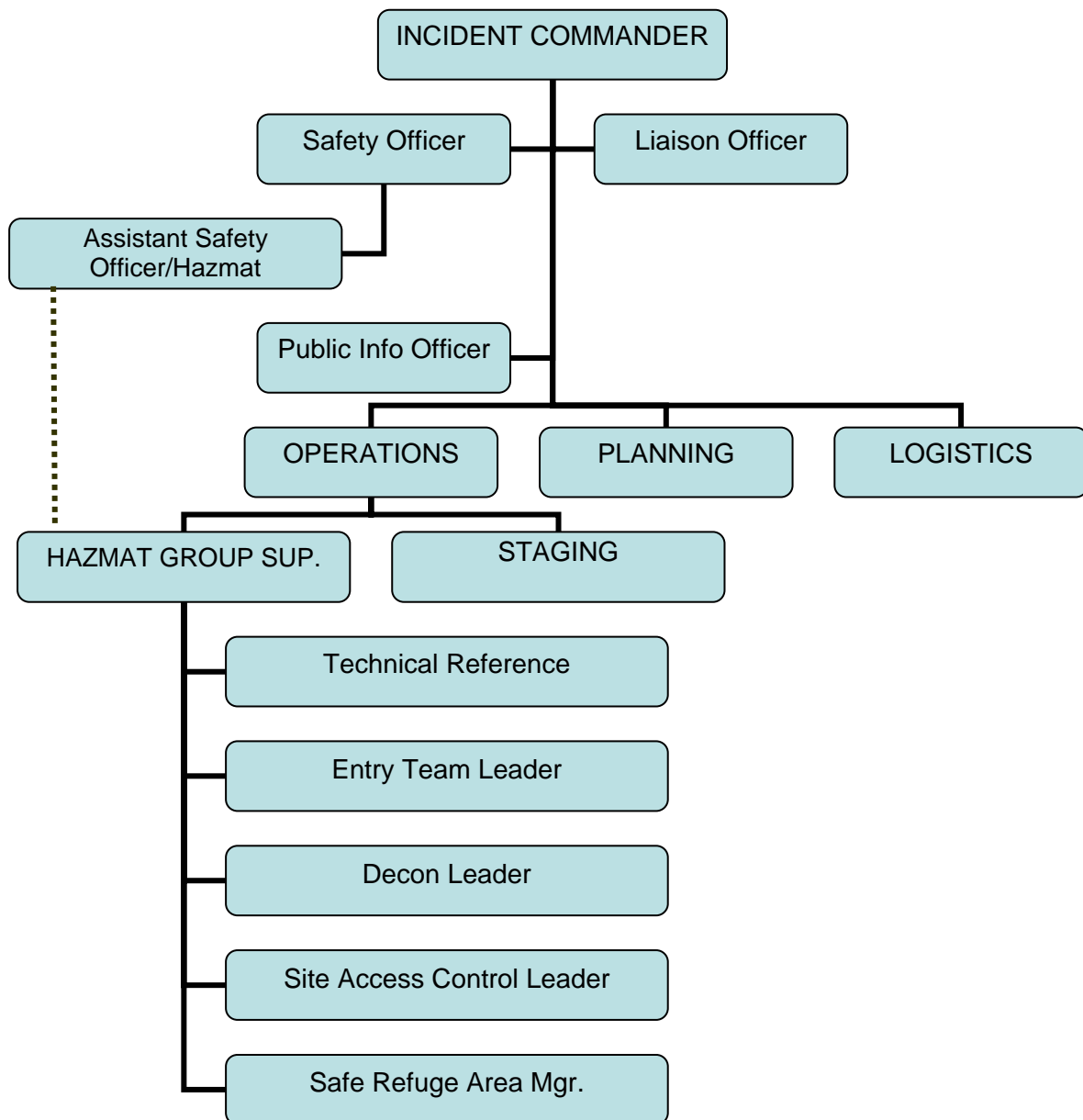
The Site Access Control Leader reports to the Hazardous Materials Group Supervisor. The Site Access Control Leader is responsible for the control of the movement of all people and equipment through appropriate access routes at the hazard site and ensures that contaminants are controlled and records are maintained.

The Hazardous Material Safety Officer reports to the Incident Safety Officer, if activated, or the Incident Commander and coordinates with the Hazardous Materials Group Supervisor. The Hazardous Material Safety Officer coordinates safety related activities directly related to the Hazardous Material Group operations as mandated by 29 CFR part 1910.120 and applicable State and local laws. This position advises the Hazardous Materials Group Supervisor on all aspects of health and safety and has the authority to stop or prevent unsafe acts. **It is mandatory that a Hazardous Materials Safety officer be appointed at all hazardous materials incidents.** In a multi-activity incident, the Hazardous Material Safety Officer does not act as Safety Officer for the overall incident.

The Safe Refuge Manager reports to the Hazardous Materials Group Supervisor. This position is responsible for all activities taking place in the Safe Refuge Area. The Safe Refuge Area is the designated location where contaminated persons will congregate before they enter the Decontamination Corridor to be decontaminated.

The Technical Specialist-Hazardous Materials Reference reports to the Hazardous Materials Group Supervisor. This position provides technical information and assistance to the Hazardous Materials Group using various reference sources such as computer data bases, technical journals, ChemTrec, and phone contact with facility representatives. The Technical Specialist Hazardous Materials Reference may provide

product identification using hazard categorization tests and/or any other means of identifying unknown materials.





## **SECTION 2. FIRST RESPONDER FUNCTIONS AND ON-SCENE ACTIONS**

### **RELEASE OF KNOWN OR SUSPECTED HAZARDOUS MATERIALS**

The first arriving Fire Department unit shall:

1. Approach incident location from upwind and uphill.
2. Position apparatus back from the incident location.
3. Implement protection measures:
  - a. Personnel upwind/uphill
  - b. Apparatus upwind/uphill
  - c. Don Positive pressure SCBA
  - d. Wear Full protective clothing (turnouts, pants, coat, gloves, boots, helmet)
  - e. Keep a safe distance
  - f. Avoid contact with released product
  - g. Avoid action until product identified and hazards known
4. Consider all unidentified containers or released products (including smoke) as a hazardous material until identified as non hazardous.
5. Size up 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 Department of Emergency Communications 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, shipping papers, and/or material safety data sheets
9. Get as much information regarding the incident as possible. Technical assistance is available from:

SECTION 2. FIRST RESPONDER FUNCTIONS AND ON-SCENE ACTIONS

- a. The North American Emergency Response Guidebook (NAERG), which is carried on all SFFD apparatus (good reference source for the first 10-20 minutes of an incident for initial actions)
  - b. Material Safety Data Sheets (MSDS)
  - c. Facility Emergency Response and Training Plans, facility maps, and when applicable, Risk Management Programs (R.M.P.)
  - d. Emergency contacts of the responsible party or business
  - e. The Poison Control Center
  - f. Chemists at the Southeast Sewage Treatment Plant (648-6882), and SF Recycling and Disposal (Sanitary Fill), 501 Tunnel Rd (330-1400)
  - g. Manufacturers of the involved chemical
  - h. Representatives of the affected facility
10. Notify Communications Center of situation and product involved.
11. Request indicated assistance:
- a. Fire Department units
  - b. HazMat Team (automatically dispatched on Level II and III incidents)
  - c. Paramedics
  - d. Police:
    - 1) Traffic control
    - 2) Perimeter control
    - 3) Evacuation
  - e. Technical support:
    - 1) Technical advisors
    - 2) Monitoring equipment
12. Perform site management: rescue, isolation, control, evacuation (RICE):
- a. Rescue:
    - 1) If immediate rescue is indicated, perform only with awareness of hazard and minimum number of personnel. Avoid as much personal contact as possible.
    - 2) Rescue should only be attempted while wearing full protective clothing and when the risk to personnel is known. Use caution, do not become a casualty.
    - 3) When the hazard is unknown, rescue should not be initiated until the HazMat Team has assessed the situation.
  - b. Isolate immediate release area:
    - 1) Remove all unnecessary personnel and civilians from immediate release area.

SECTION 2. FIRST RESPONDER FUNCTIONS AND ON-SCENE ACTIONS

- 2) Establish control zones (Hot and Warm Zones). Reference the NAERG Table of Isolation and Evacuation distances for recommended distances.
    - 3) Deny entry to people/vehicles.
  - c. Control the material from a defensive posture:
    - 1) Confine product to as small an area as possible.
    - 2) Prevent container failure.
    - 3) Contain the product to original container whenever possible by closing valves, plugging holes, repositioning container, etc..
    - 4) Protect exposures.
    - 5) Extinguish fires if appropriate and safe.
    - 6) Contain contaminated run off.
    - 7) Prevent hazardous and toxic materials from entering sewers, bay, etc..
  - d. Evacuate:
    - 1) Evacuate as necessary. Reference the NAERG Table of Isolation and Evacuation distances.
    - 2) Heating, Ventilating, and Air Conditioning systems (HVAC) in exposed buildings may need to be shut down.
    - 3) Consider movement of people in exposed buildings to the far side of the building and then evacuate, if appropriate.
13. Action should be avoided until product is identified and hazards known. If considered safe by on scene personnel, perform indicated service (reposition container, dike, plug, cover with foam or tarp, etc.):
  - a. Commit two members (team)
  - b. Wear full protective clothing and PP SCBA
  - c. Approach from upwind
  - d. Avoid direct contact with product
  - e. Limit exposure time as much as possible
  - f. Limit spread of contamination
14. No action, if product cannot be identified and/or personnel cannot perform control action safely:
  - a. Isolate immediate release area
  - b. Maintain perimeter control until arrival of police
  - c. Await arrival of HazMat Team
  - d. Limit spread of contamination

## **INCIDENT COMMANDER**

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, the situation must be reevaluated.

The materials involved must be identified so the associated hazards can be identified and proper control measures carried out. Without proper and prompt identification, accurate corrective actions cannot be undertaken. All unidentified materials should be considered worst case scenarios until they are properly identified. Personnel should never enter the potential dispersion area until the risks are assessed by the Haz Mat Team.

The Incident Commander will relay information to the Communications Center about the hazardous material incident. This information will help expedite the alerting process for on site mitigation activities. Requests for assistance from other appropriate City, State, and Federal agencies shall be made through the Communications Center. Required reporting notifications shall be made by the DPH Emergency Responder.

The initial Command Post (CP) should be set up with the first on scene apparatus. As the situation progresses, a more complete Command Post may be required. All persons and agencies requested to help will be directed to the Command Post for instructions, directions, assignments and incident information.

The location of the Command Post should be upwind a safe distance back from the hazardous material incident site, and in the Cold Zone. The Cold Zone is the safe area beyond the boundaries of the incident. When the Command Post is established, the Communications Center shall be notified immediately of the location and proper approach routes. The Communications Center shall convey this information to all other responders.

Staffing the Command Post is vitally important. Sometimes, persons without uniform rank or persons from other departments may be assigned responsibilities. Many functions of the Command Post at hazardous materials emergencies are similar to those encountered at major fires.

## **HAZMAT TEAM INITIAL ON-SCENE ACTIONS**

### **Hazmat Group Supervisor**

As part of size up, the HazMat Group Supervisor and the Incident Commander shall confer regularly and always before initiating any control actions. The HMG should verify any identification or problem assessment conducted by others. It is often appropriate to



scan the incident scene with binoculars from an upwind vantage point outside any immediate potential dispersion zone, to conduct a preliminary size up. Technical references should always be consulted to figure out the hazard(s) of the material(s) involved.

### **Perimeter Survey Team**

Immediately after the preliminary size up, monitoring should begin to find the area of involvement. Two Hazardous Materials Group (HMG) members will act as the Perimeter Survey Team and conduct a survey around the perimeter of the incident. The information gathered by the Perimeter Survey Team is assessed at the Command Post and is used to make a site map and develop the Site Safety Plan.

The Perimeter Survey Team shall conduct a survey around the perimeter of the incident to gather information on the physical layout of the incident site and any additional information that will help identify the specific hazards on-site. Depending on the size of the incident, more than one Perimeter Survey Team may be needed. The Perimeter Survey Team shall be equipped with Positive Pressure Self Contained Breathing Apparatus (PP SCBA), appropriate protective clothing, suitable monitoring equipment, binoculars and a portable radio. A Polaroid or digital camera and cassette tape recorder also might be appropriate. The initial isolation area shall not be entered for survey purposes unless specifically approved by the Entry Team Leader. Every attempt shall be made to view the incident from all sides at a safe distance. Combustible gas readings will be taken around the complete perimeter, especially downhill and downwind whenever it is suspected that a flammable is involved. All reasonable efforts should be made to avoid contact with the hazardous material.

### **Monitoring**

Monitoring shall be done where there may be a question of employee exposure to dangerous concentrations of hazardous substances to insure proper selection of engineering controls, work practices, and personal protective equipment. Personnel are not to be exposed to concentrations that exceed permissible exposure limits or published exposure levels for hazardous substances.

Air monitoring shall be used to identify and quantify airborne levels of hazardous substances and safety and health hazards, to decide the appropriate level of employee protection needed on site.

Upon initial entry into the Hot Zone, representative air monitoring shall be conducted to identify any Immediate Danger to Life and Health (IDLH) condition, exposure over permissible exposure limits, 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.

## SECTION 2. FIRST RESPONDER FUNCTIONS AND ON-SCENE ACTIONS

Periodic monitoring should always be conducted, especially when the possibility of an IDLH condition or flammable atmosphere has developed or when there is an indication that exposure levels have risen. Situations indicating the need for additional monitoring include:

- When work begins on a different portion of the site
- When contaminants other than those previously identified are handled
- When a different type of operation is initiated
- When personnel are handling leaking drums or containers, or working in areas with obvious liquid contamination

### **IDENTIFICATION**

Every attempt should be made to answer, identify or confirm the following:

1. The type of incident:
  - a. Hazardous material release, with fire
  - b. Hazardous material release, no fire
  - c. Hazardous material involved, no release apparent, with fire
  - d. Hazardous material involved, no release apparent, no fire
  - e. Hazardous material involved with release or generation of a cloud of mist, steam, vapor, etc.
2. Are there any injured or trapped people?
3. What are the materials involved?
4. What type and size of container?
5. Has the container been stressed or breached?
6. What quantities are involved?
7. What are the hazards?
8. Are there any associated hazards?
9. What are the exposures and related problems?

When the Haz Mat Group is unable to identify the involved material(s) or it's properties, or the severity of the hazard cannot immediately be determined, or the proper course to abate the hazard is unclear, the Incident Commander shall immediately seek technical assistance.

Direct contact with technical advisors is recommended to avoid confusion and save time. This contact can be made by using a cellular telephone. If on scene advice is required, the Incident Commander can request a technical advisor to respond.

Requests for technical advisors or equipment should be made through the Communications Center.

## **TECHNICAL ASSISTANCE**

Technical assistance is available from:

1. The North American Emergency Response Guidebook (NAERG) (good reference source for the first 10-20 minutes of an incident for initial actions)
2. The Department of Public Health's on call Emergency Responders
3. Computer databases available on the Hazardous Materials Unit and through the Department of Public Health.
4. Reference books in the Hazardous Materials Unit
5. Material Safety Data Sheets (MSDS).
6. Facility Emergency Response and Training Plans, facility maps, and when applicable, Risk Management Programs (R.M.P.)
7. Emergency contacts of the responsible party or business.
8. The Poison Control Center (1-800-523-2222)
9. Chemists at the Southeast Sewage Treatment Plant (648-6882), and SF Recycling and Disposal (Sanitary Fill), 501 Tunnel Rd (330-1400)
10. CHEMTREC (1-800-424-9300)
11. Manufacturers of the involved chemical (Contact can be made through CHEMTREC.)
12. Representatives of the affected facility

## **PROTECTION OF PERSONNEL**

Protection of emergency response personnel at a hazardous materials incident is paramount. The three primary methods to protect personnel are time, distance and shielding. Even when personnel are wearing the proper level of protective clothing, exposure time of personnel shall be kept to a minimum.

The Incident Commander shall take precautions to avoid exposure of response personnel and 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. Critical system disruption

## SECTION 2. FIRST RESPONDER FUNCTIONS AND ON-SCENE ACTIONS

- a. Utilities
- b. Transportation
3. Environmental damage
4. Property damage
5. Legal implications
6. Traffic control

Proper distance from the hazardous material can be determined by identifying the material involved and assessing the associated hazards using technical references. Then the initially established Incident Control Zones can be adjusted.

All on scene Fire Department personnel except for HazMat Team members shall don full protective fire fighting clothing (coat, pants, boots, gloves, helmet, and PP SCBA) and take all necessary steps to avoid contamination of themselves, others, property, and the environment.

All personnel should remain upwind from the incident site, unless properly protected and performing a necessary function.

Do not drink, eat or smoke near hazardous materials incidents. Segregate clothing and tools used at the incident and suspected of contamination. These items shall be decontaminated or properly disposed of.

The primary aspects of hazardous materials response include (RICE)

- Rescue
- Isolation
- Control
- Evacuation

Remove injured persons from the contaminated area with as little direct personal contact as possible. SKEDs, Raven Decontaminable Stretchers, Stingray litters, and Roll-eze Stretchers are available for assisting in the removal of injured persons. Persons who may have had contact with the materials should be isolated and held in the Safe Refuge Area near the Decontamination Corridor until decontamination can be done. Trained and equipped Paramedics or EMTs can provide medical treatment in the Safe Refuge Area, if needed.

If serious injury has occurred demanding more than first aid measures, the patient should be decontaminated and treated before transport to the hospital. Medical personnel, paramedics, and the receiving hospital must be advised of any possible contamination, the name of the possible contaminant(s), and any decontamination procedures already taken.

Control zones shall be established to prevent unauthorized persons from entering the area and to control the amount of contaminants leaving the area.

Establishing the recommended distances in the North American Emergency Response Guidebook to isolate or evacuate people from spill areas can protect the public. The public should be kept as far back from the incident as possible. Where subsequent legal action may be required, the scene must be protected from contact by non-official persons. Souvenir hunting and the handling of debris must not be allowed. The media will be allowed to approach the Command Post as allowed by California Penal Code 409.5, but they should be directed to the Information Officer. The media can be barred from the area if it is a declared crime scene. Media who enter a contaminated area must also go through the required decontamination processes.

Ignition sources should be eliminated whenever possible at incidents involving releases, or probable releases of flammable materials. Whenever possible, electronic devices used within the Hot Zone should be certified as intrinsically safe. Radios and voice amplifiers used within totally encapsulating protective suits do not need to comply with the above.

The confinement of the spilled material to the smallest possible area will help in keeping a hazardous material incident from becoming a hazardous material emergency. Hazardous and toxic materials should not be flushed. Every effort should be made to prevent the material from entering sewer drains, drainage ditches, or any other channel for liquids by diking, plugging, or absorbing. Spreading sand or dirt or building a dike ahead of the spill will help in confining liquid spills.

Confining released materials helps to minimize exposure problems. For incidents requiring the application of water for extinguishing or cooling, contaminated run off must be confined and contained for proper disposal.

A prompt evacuation of the threatened area using police or other assistance may be required. Considerations for evacuation should include:

1. Exposure risk to those considered for evacuation
2. Geographic area to be evacuated
3. Time available for evacuation
4. Where evacuees should be relocated
5. Duration of contaminant exposure
6. Personnel available for evacuation operations
  - a. Firefighters
  - b. Law enforcement
  - c. Service organizations
  - d. National Guard or other military units, if at incident site or available

Instead of evacuation, a shelter-in-place action may be preferable. Shelter-in-place will be determined by the Incident Commander with guidance from the DPH Emergency Responder. Shelter-in-place directives can be communicated by:

- Directly contacting facility managers or building security
- Loudspeakers from the City Siren System, public safety vehicles or megaphones
- Through the Emergency Alert System (EAS). Building occupants will be told to stay indoors, close all doors, seal openings of doors and windows, turn off ventilation systems, stay in the innermost rooms, and turn on a radio to an EAS station to keep apprised what other actions to take and for clearance

Besides specific actions, common sense rules should be observed at the scene of hazardous materials incidents.

The Hazardous Material Unit is not designed to transport hazardous materials, and the Fire Department is not equipped to do so. Also, hazardous materials are not to be brought back to stations by any company or unit, and hazardous materials are not to be accepted at fire stations.

During normal working hours, The DPH has a vehicle available to haul small quantities of hazardous materials. They can be contacted through the Department of Public Health by calling 252-3800, and asking for the Hazardous Waste Program. After hours, page the DPH Emergency Responder at 252-3855.

San Francisco residents desiring to dispose of household hazardous waste should be encouraged to take their hazardous waste to the Household Hazardous Waste Facility at 501 Tunnel Avenue where they may legally dispose of their hazardous waste for free. The facility is open three (3) days a week, Thursday, Friday, and Saturday from 0800 until 1600. Businesses needing to dispose of hazardous waste should be told to hire a hazardous waste hauler to dispose of their hazardous waste. Businesses that generate small amounts of hazardous waste can contact Sanitary Fill at 330-1425 and see if they can dispose of hazardous waste through the Very Small Quantity Generator (VSQG) Program.

## **GROSS DECONTAMINATION PROCEDURES FOR FIRST RESPONDERS**

### **Operating Guidelines**

Whenever a company responds to a dispatch which the company officer knows or suspects is a hazardous materials, terrorist, or Chemical, Biological, Radiological, Nuclear, or Explosive (CBRNE) event, he/she must be prepared to establish gross decontamination for contaminated victims.

## Actions

The guidelines outlined should be carried out as quickly as possible.

1. The first arriving unit will stop a safe distance from the scene. Members will wear full protective clothing including SCBAs and latex gloves. Identify a safe refuge area and direct victims to go there for gross decontamination. The safe refuge area must be far enough away from the scene and preferably upwind so as to not expose victims to further contamination or harm.
2. Decision to initiate gross decontamination will be based on signs and symptoms of exposed victims and if agent is known. If gross Decon is needed, securing a continuous water supply is necessary. Decontamination will be done by leading one or two small lines, depending on the number of victims, spraying victims at low pressure (50 psi) with spray settings set at 60 degrees on nozzles. Victims will be directed to approach the hose lines for wetting. Using a loud and commanding voice, direct them to raise their arms and spread their legs to effect complete decontamination. After wetting, they will be required to remove their clothing down to their underwear, and then be flushed again while raising their arms and spreading their legs. If a liquid directly contaminates a victim, removal of undergarments may be required. Every effort will be made to account for modesty. Clothing and personal belongings will be bagged and tagged for identification. Victims will be given blankets, disposable clothing, etc. to protect them from the elements.
3. The second arriving engine will make a supply lead from a hydrant to the incident if not already done by the first engine. They shall initiate decontamination procedures if necessary. They will be prepared for fire fighting if necessary. All personnel must wear full protective equipment.
4. Victims must not come in contact with the First Responders, but should contact be made, flush the affected area with water. If gross decontamination of First Responders is necessary, procedures for civilian decontamination should be used. This would include wet, strip, and flush methods, and the bagging of their clothing and personal belongings.
5. All units responding to a WMD event must be cognizant of the possibility of a secondary device. The search for and mitigation of secondary devices will be handled by the Explosive Ordinance Disposal (EOD) unit, but First Responders should check the area around their apparatus for any suspicious devices.
6. Upon arrival of the Metropolitan Medical Task Force (MMTF), the first responding companies duties will be as directed by the Decon Team Leader or the Incident Commander.

## **INCIDENT ANALYSIS AND REPORTS**

### **Post Action Review**

Before leaving the scene of a Level I occurrence, a Post Action Review of individual actions taken and significant factors concerning the incident should be conducted by the Incident Commander with the HazMat Team and other involved personnel. For Level II and Level III incidents, it may be more appropriate to conduct this review away from the scene.

### **Post Incident Assessment**

A Post Incident Assessment of Level II and III occurrences (critique) should be scheduled when practicable after each hazardous material incident. The objective of the assessment is to identify both strong and weak points of the command and control functions. All parties who participated at the incident officially with other interested Fire Department personnel should attend. Pictures, slides, videotapes, and news clips could be used to help in the assessment.

### **Reports**

A General Form report to the Deputy Chief of Operations containing an itemized list and cost of contaminated equipment, etc. should be made when applicable.

An after action incident report for all Level II and III incidents shall be compiled by the Incident Commander. This report will include data submitted by the involved departments; summarize salient topics of discussion during the post action review; be objective (no fault) in nature; and emphasize lessons learned.

Additionally, an entry in red ink shall be made in the hazardous materials response book at Station 36 containing the following information:

- Time of the incident
- Incident number
- Address/Location of the incident
- Name of hazardous material(s) involved
- Quantity of material(s) involved
- Approximate quantity of material(s) released
- Company number of any crews potentially exposed
- Name of responsible party
- Name of incident commander

When any San Francisco Fire Department unit responds to an incident that involves a hazardous material and the HazMat Team was not dispatched, no matter how



## SECTION 2. FIRST RESPONDER FUNCTIONS AND ON-SCENE ACTIONS

insignificant the incident may have appeared (except for minor spills of motor fuel), the responding officer shall notify the officer of E 36 of the incident. Notification shall be made between the hours of 0700 and 2100 hours. The officer of E 36 will make an entry in the hazardous materials response book of this incident in blue ink. The purpose of this entry is to help in determining the amount and types of incidents involving hazardous materials occurring in the City and County of San Francisco.

In addition to these reports, the DPH Emergency Responders draft reports of all incidents they are asked to respond to. Some of these incidents may not have included the HazMat Team. These reports are sent to Battalion 2 and the Fire Department Occupational Physician.



## **SECTION 3. HAZMAT INCIDENT PERSONNEL**

### **THE INCIDENT COMMANDER (IC)**

The Incident Commander (IC) should promptly establish a Command Post for all incidents involving hazardous materials. A Command Post Packet for hazardous materials incidents is carried on the Hazardous Materials Unit. California Title 8, Section 5192 and Code of Federal Regulation 29 CFR 1910.120 requires all emergency response personnel who serve as Incident Commander to receive 24 hours of Incident Command System Training.

### **RESPONSIBILITIES**

The Incident Commander shall ensure that the hazardous material is contained for subsequent and proper disposal, shall make every possible effort to locate the responsible party for the incident, and request that the responsible party takes prompt and appropriate remedial actions. The responsible party shall make the contact for cleanup or removal of the material. The cost of containment, cleanup, disposal and restoration shall be borne by the spiller of the material or the property owner.

The Incident Commander will take action as necessary to ensure restoration of the scene to a normal condition after the emergency. The role of the San Francisco Fire Department is NOT to cleanup, but to stabilize the incident. The Department of Public Health shall have final responsibility for declaring an area "safe" or "clean" when toxic products have been released.

### **HAZMAT TEAM**

The Hazardous Materials Unit is located at Station 36, 109 Oak Street. The on duty officer and members of Engine 36 will respond as members of the HazMat Team with the Hazardous Materials Unit. (Engine 36 apparatus remains in quarters, out of service.) The on duty Battalion Chief and Incident Support Specialist of Battalion 2 shall also respond as members of the HazMat Team. The on-call Emergency Responder from the DPH, Environmental Health Services responds as a member of the HazMat Team. The on-duty officer and members of the Rescue Squads may respond as members of the HazMat Team. (As an incident grows in size and complexity, the make-up of the HazMat Team will change accordingly. See page 1.8)

In the event that Engine 36 personnel are not available, the 1st due Rescue Squad at the incident shall respond to Station 36, assign two firefighters to the Hazardous Materials Unit, and respond with it and the rescue vehicle to the incident. When

### SECTION 3. HAZMAT INCIDENT PERSONNEL

available, the personnel of Engine 36 shall respond to the hazardous materials incident site to help or relieve the rescue company personnel.

This HazMat Team is the City and County of San Francisco's designated team for responding to hazardous materials incidents. This team constitutes the City and County's Hazardous Materials (HazMat) Team as defined in Title 29 CFR Section 1910.120 Paragraph (q), that responds to releases or potential releases of hazardous substances to control or stabilize the incident.

## **HAZMAT GROUP (HMG) PERSONNEL**

Due to the complexity of situations involving hazardous materials, specialized job functions must be assigned to insure the safety of personnel at the scene. Several positions described below are from the FIREScope Incident Command System Position Manuals for hazardous materials incidents. The use of these positions and the other functions described will help the Incident Commander in managing and controlling hazardous materials incidents.

- **Hazardous Material Safety Officer**
- **Hazardous Material Group Supervisor**
- **Site Access Control Leader**
- **Entry Leader**
- **Decontamination Leader**
- **Safe Refuge Manager**
- **Technical Specialist Hazardous Material Reference**
- **Entry Team**
- **Back-Up Team**

## **HAZARDOUS MATERIAL SAFETY OFFICER**

The IC shall designate a safety officer that 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.

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 officer shall immediately inform the IC of any actions needed to be taken to correct these hazards at an emergency scene.<sup>1</sup>

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<sup>1</sup> 29CFR 1910.120 (q)(3)(vii, viii)

The Hazardous Material Safety Officer reports directly to the Incident Safety Officer, if activated.

The Hazardous Material Safety Officer is assigned to the Hazardous Materials Group (or Hazardous Materials Branch if activated). This position is responsible for the overall safety of assigned personnel within the Hazardous Materials Group.

The Hazardous Material Safety Officer coordinates group activities with the Hazardous Material Group Supervisor. In a multi activity incident, the Hazardous Material Safety Officer does not act as Safety Officer for the overall incident. Therefore, it is necessary that a Hazardous Material Safety Officer be appointed at all hazardous materials incidents.

The Hazardous Material Safety Officer coordinates activities directly relating to the Hazardous Material Group operations as mandated by 29 CFR 1910.120. This position advises the Hazardous Material Group Supervisor on all aspects of health and safety and has the authority to stop or prevent unsafe acts.

Due to the responsibilities of this position, the individual should be both Safety Officer qualified (ICS 220 4), and possess a high degree of knowledge in hazardous substance mitigation operations and procedures. These abilities require that the personnel assigned to this position have minimum equivalent training and expertise as mandated by federal, state, and local laws to perform the responsibilities and procedures of this position. Preferably, this individual should have taken the California Specialized Training Institute class, "Assistant Safety Officer/Hazardous Materials".

The HazMat Group Supervisor or the Incident Commander will assign the Hazardous Materials Safety Officer. In smaller incidents, the HazMat Group Supervisor can assign himself/herself to take this role. Some members of the HazMat Team and DPH Emergency Responders have received California State Training Institute (CSTI) training as Assistant Safety Officer/Hazardous Materials. When there is a shortage of Fire Department personnel, the DPH Emergency Responder can serve as the Hazardous Materials Safety Officer.

### **Responsibilities**

The major responsibilities of the Hazardous Material Safety Officer are stated below. The procedures for implementing the responsibility are found in detail on the clipboard of the Hazardous Material Safety Officer.

- Check in and obtain briefing from the Incident Safety Officer, if activated
- Obtain briefing from the Hazardous Material Group Supervisor
- Participate in the preparation of, and implement the Site Safety Plan

### SECTION 3. HAZMAT INCIDENT PERSONNEL

- Advise the Hazardous Material Group Supervisor (or Hazardous Materials Branch Director if activated) of deviations from the Site Safety Plan or any dangerous situations
- Has full authority to alter, suspend, or terminate any activity that may be judged to be unsafe
- Ensure protection of the Hazardous Material Group personnel from physical, environmental, and chemical hazards/exposures
- Ensure provision of required emergency medical services for assigned personnel and coordinate with the Medical Unit Leader
- Ensure that medical related records for the Hazardous Materials Group personnel are maintained
- Maintain Unit Log (ICS Form 214)<sup>2</sup>

The portable radio will be used by Hazardous Materials Safety Officer to notify personnel in the Hot Zone to withdraw and alert all support personnel to prepare to receive those personnel.

## **HAZARDOUS MATERIALS GROUP SUPERVISOR**

The Hazardous Materials Group Supervisor is assigned to the Operations Section (or Hazardous Materials Branch if activated).

The Hazardous Materials Group Supervisor reports to the Operations Section Chief.

The Hazardous Materials Group Supervisor is responsible for the implementation of the phases of the Incident Action Plan dealing with the Hazardous Materials Group operations.

The Hazardous Materials Group Supervisor is responsible for the assignment of resources within the Hazardous Material Group, reporting on the progress of control operations and the status of resources within the Group.

The Hazardous Materials Group Supervisor directs the overall operations of the Hazardous Material Group.

The Hazardous Materials Group Supervisor is part of an organizational structure designed to provide the Operations Section Chief with personnel, equipment, and expertise to safely mitigate a hazardous materials incident. Personnel in this position must be able to assess, measure, and determine the most effective and safe means to abate the hazardous substance(s).

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<sup>2</sup> ICS HAZMAT POSITION MANUAL 222-5, 9/91

The Hazardous Material Group Supervisor must have a thorough knowledge of operational procedures, risk analysis and safety considerations relating to hazardous materials incident management.

### **Responsibilities**

The major responsibilities of the Hazardous Material Group Supervisor are stated below. The procedures for implementing the activity are found in detail on the clipboard of the Hazardous Material Group Supervisor. Note that some activities are one-time actions, while others are on-going or repetitive for the duration of the incident.

- Check in and obtain briefing from the Operations Section Chief or Hazardous Materials Branch Director (if activated)
- Ensure the development of Control Zones and Access Control Points and the placement of appropriate control lines
- Evaluate and recommend public protection action options to the Operations Section Chief or Branch Director (if activated)
- Ensure that current weather data and future weather predictions are obtained
- Establish environmental monitoring of the hazard site for contaminants
- Ensure that a Site Safety Plan is developed and implemented
- Conduct safety meetings with the Hazardous Materials Group
- Participate, when requested, in the development of the Incident Action Plan. (Develop the Hazardous Materials attachment to the Incident Action Plan)
- Ensure that nationally recommended safe operational procedures are followed
- Ensure that the proper Personal Protective Equipment (PPE) is selected and used
- Ensure that appropriate allied agencies are notified through the Incident Commander
- Maintain Unit Log (ICS Form 214)<sup>3</sup>

### **SITE ACCESS CONTROL LEADER**

The Site Access Control Leader is assigned to the Hazardous Materials Group (or Hazardous Materials Branch if activated).

The Site Access Control Leader reports to the Hazardous Materials Group Supervisor.

The Site Access Control Leader is responsible for the control of the movement of all people and equipment through appropriate access routes at the hazard site. This

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<sup>3</sup> ICS HAZMAT POSITION MANUAL 222-5, 9/91

### SECTION 3. HAZMAT INCIDENT PERSONNEL

position ensures that the spread of contaminants is controlled and that records are maintained.

Only one Site Access Control Leader should be established for the whole site even if the site covers a large area containing multiple groups or division.

The Site Access Control Leader is responsible for providing the Hazardous Materials Group Supervisor with control over the movement of all personnel and equipment between control zones.

Because of the need to isolate the Hot Zone and Decontamination Corridor, the Site Access Control Leader is identified early in the incident to ensure that citizens and personnel use proper access and egress routes.

The Site Access Control Leader should enlist the assistance of police officers for larger incidents, but at smaller incidents it is expedient to have firefighters perform security functions. The Hazardous Materials Group Supervisor can assign a trained police officer to become the Site Access Control Leader.

The Site Access Control Leader and security personnel must remain out of the Hot Zone and be provided with the proper level of protective clothing when working in the Warm Zone. All personnel entering the Hot and Warm Zones should clear through the Site Access Control Leader.

The Site Access Control Leader will control personnel entering the Hot Zone to ensure that they are properly protected. The Site Access Control Leader should also establish the Decontamination Corridor and be familiar with the various levels of protective clothing available and medical implications of the incident.

The Site Access Control Leader must be alert to any signs or symptoms of exposure and should provide paramedic personnel with as much accurate information as practical that can be sent to the hospital with exposed persons. If acute exposure of personnel is known or suspected, medical examinations must be ordered.

The Site Access Control Leader maintains a log that should include, but not be limited to:

- Times of significant occurrences within the Hot Zone
- Products involved
- Names of personnel entering the Hot Zone
- Clocking time in and time out
- Protective equipment of personnel entering the Hot Zone
- Functions of personnel entering the Hot Zone



The log will contain essential information should any exposed persons develop health problems in the future.

These abilities require that personnel assigned to this position have the minimum equivalent training and expertise as mandated by federal, state, and local laws to perform the responsibilities and procedures of this position.

### **Responsibilities**

The major responsibilities of the Site Access Control Leader are stated below. The procedures for implementing the activity are found in detail on the clipboard of the Site Access Control Leader. Note that some activities are one-time actions while others are ongoing or repetitive for the duration of the incident.

- Check in and obtain briefing from the Hazardous Materials Group Supervisor
- Organize and supervise assigned personnel to control access to the hazard site
- Oversee the placement of the Hot Line and Contamination Control Line. (see page 1.9)
- Ensure that appropriate action is taken to prevent the spread of contamination
- Establish the Safe Refuge Area near the Decontamination Corridor. Appoint Safe Refuge Area Manager (as needed)
- Ensure that injured or exposed individuals are decontaminated prior to departure from the hazard site
- Track persons passing through the Decontamination Corridor to ensure that long-term observations are provided
- Coordinate with the Medical Group for proper separation and tracking of potentially contaminated individuals needing medical attention
- Maintain observations of any changes in climatic conditions or other circumstance external to the hazard
- Maintain communications and coordinate operations with the Entry Team
- Maintain communications and coordinate operations with the Decontamination Leader
- Maintain Unit Log (ICS Form 214)<sup>4</sup>

### **ENTRY LEADER**

The Entry Leader is assigned to the Hazardous Materials Group (or Hazardous Materials Branch if activated).

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<sup>4</sup> ICS HAZMAT POSITION MANUAL 222-1, 9/91

The Entry Leader reports to the Hazardous Materials Group Supervisor. The Entry Leader is responsible for the overall entry operations of assigned personnel with the Exclusion Zone.

### **Responsibilities**

The major activities of the Entry Leader are listed below. The procedures for implementing the activity are found in detail on the clipboard of the Entry Leader. Note that some activities are one-time actions while others are ongoing or repetitive for the duration of the incident.

- Check in and obtain briefing from the Hazardous Materials Group Supervisor.
- Supervise entry operations. Ensure there is/are backup team(s).
- Recommend actions to mitigate the situation within the Hot Zone.
- Initiate actions, as directed by the Hazardous Materials Group Supervisor, to mitigate the hazardous materials release or threatened release.
- Maintain communications and coordinate operations with the Decontamination Leader.
- Maintains communications and coordinates operations with the Site Access Control Leader.
- Maintains communications and coordinates operations with Technical Specialist Hazardous Materials Reference.
- Maintains control of the movement of people and equipment within the Hot Zone, including contaminated victims.
- Directs rescue operations, as needed, in the Hot Zone.
- Maintains Unit Log (ICS Form 214).<sup>5</sup>

## **DECONTAMINATION LEADER**

The Decontamination Leader is assigned to the Hazardous Materials Group (or Hazardous Materials Branch if activated).

The Decontamination Leader reports to the Hazardous Materials Group Supervisor.

The Decontamination Leader is responsible for all activities taking place in the area designated as the Decontamination Corridor.

The Decontamination Leader is responsible for the decontamination of persons and equipment that leave the Hot Zone and the maintenance of records for the unit.

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<sup>5</sup> ICS HAZMAT POSITION MANUAL 222-4, 9/91

The Decontamination Leader is responsible for providing the Hazardous Materials Group Supervisor with the expertise to ensure that the area of contamination does not spread beyond the Decontamination Corridor, either from contaminated equipment, contaminated people, or contaminated water.

These responsibilities require that personnel assigned to this position have the minimum equivalent training and expertise as mandated by Federal, State, and local laws to perform the responsibilities and procedures of this position.

### **Responsibilities**

The major activities of the Decontamination Leader are listed below. The procedures for implementing the activity are found in detail on the clipboard of the Decontamination Leader. Note that some activities are one-time actions while others are ongoing or repetitive for the duration of the incident.

- Check in and obtain briefing from the Hazardous Materials Group Supervisor
- Establish Decontamination Corridor
- Identify contaminated people and equipment
- Sets up gross decontamination, if needed
- Supervise the operations of decontamination of people and equipment
- Maintain control over movement of people and equipment within the Decontamination Corridor. Sets up separate decontamination lines for responders and public, if needed. Sets up modesty tents, if needed
- Maintain communications and coordinate operations with the Entry Leader
- Maintain communications and coordinate operations with the Site Access Control Leader
- Coordinate the transfer of contaminated patients requiring medical attention (after decontamination) to the Medical Group
- Coordinate handling, storage, and transfer of contaminants within the Decontamination Corridor
- Maintains Unit Log (ICS Form 214)<sup>6</sup>

### **SAFE REFUGE MANAGER**

The Safe Refuge Manager is assigned to the Hazardous Materials Group (or Hazardous Materials Branch, if activated).

The Safe Refuge Manager reports to the Hazardous Materials Group Supervisor.

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<sup>6</sup> ICS HAZMAT POSITION MANUAL 222-4, 9/91

The Safe Refuge Manager is responsible for all activities taking place in the Safe Refuge Area. The Safe Refuge Area will be the location near the Decontamination Corridor where citizens, victims, and emergency response personnel await to be decontaminated before entering the Decontamination Corridor. This is a location where medical treatment can be provided before decontamination, if needed.

The Safe Refuge Manager is responsible for providing the Hazardous Materials Group Supervisor with the expertise to ensure that the area of contamination does not spread beyond the Hot or Warm Zones.

### **Responsibilities**

The major activities of the Safe Refuge Manager are listed below. The procedures for implementing the activity are found in detail on the clipboard of the Safe Refuge Manager. Note that some activities are one-time actions while others are ongoing or repetitive for the duration of the incident.

- Check in and obtain briefing from the Hazardous Materials Group Supervisor.
- Determine need for Safe Refuge Area. Numerous contaminated persons will require the establishment of the Safe Refuge Area
- Designate area near or next to Decontamination Corridor for the Safe Refuge Area. Check with the Decontamination Leader for agreement
- Don appropriate personal protective equipment. Level of personal protective equipment should be at least the same level as those in the Decontamination Corridor
- If possible, demarcate the boundaries of the Safe Refuge Area using cones, barrier tape, or other articles
- Perform triage of injured individuals. Designate the order of persons to be decontaminated
- If possible and if qualified, perform emergency medical treatment on injured individuals
- Maintain communications and coordinate operations with the Decontamination Leader and the Hazardous Materials Group Supervisor
- Maintain Unit Log (ICS Form 214)<sup>7</sup>
- Report to the Haz Mat Group Supervisor when services are no longer required

## **TECHNICAL SPECIALIST-HAZARDOUS MATERIAL REFERENCE**

The Technical Specialist-Hazardous Materials Reference is assigned to the Hazardous Materials Group (or Hazardous Materials Branch if activated).

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<sup>7</sup> ICS HAZMAT POSITION MANUAL 222-4, 9/91

The Technical Specialist-Hazardous Materials Reference reports to the Hazardous Materials Group Supervisor.

The Technical Specialist-Hazardous Materials Reference is responsible for providing technical information and assistance to the Hazardous Materials Group and the Planning Section using various sources such as computer data bases, technical journals, public and private technical information agencies, facility representatives and product specialists.

The Technical Specialist-Hazardous Materials Reference may provide product identification, verification, physical properties and hazardous characteristics using various technical references, hazard categorization tests and/or by any other available means.

The Technical Specialist-Hazardous Materials Reference function is part of an organizational structure designed to provide the Incident Commander with the expertise to identify and assess hazards, measure operational benefits, and determine environmental impacts of hazardous substance releases.

Personnel in this position must be able to provide technical assistance and provide strategic and tactical information to safely mitigate the incident.

For most HazMat incidents, the DPH Emergency Responder will serve as the Technical Specialist–Hazardous Materials Reference. For fixed facilities, the DPH Emergency Responder may have access to inventories of hazardous materials.

### **Responsibilities**

The major responsibilities of the Technical Specialist-Hazardous Materials Reference are stated below. The procedures for implementing the activity are found in detail on the clipboard of the Technical Specialist-Hazardous Materials Reference. Note that some activities are one-time actions while others are ongoing or repetitive for the duration of the incident.

- Check in and obtain briefing from the Hazardous Materials Group Supervisor or Hazardous Materials Branch director (if activated) and the Planning Section Chief (if activated)
- Provide technical support to the Hazardous Materials Group Supervisor.
- Maintain communications and coordinate operations with the Entry Leader
- Provide and interpret environmental monitoring information
- Provide analysis of hazardous material sample
- Determine personal protective equipment compatibility to hazardous material
- Provide technical information of the incident for documentation

### SECTION 3. HAZMAT INCIDENT PERSONNEL

- Provide technical information management with public and private agencies (i.e. Poison Control Center, CHEMTREC, State Department of Food and Agriculture, National Response Team)
- Assist Planning Section with projecting the potential environmental effects of the release
- Maintain Unit Log (ICS Form 214)<sup>8</sup>

## **ENTRY TEAM**

The Entry Team operates under the “buddy system” and is composed of two or more HazMat Group members assigned to do the necessary functions within the Hot Zone to mitigate the hazardous materials release or threatened release. As an incident grows in size and complexity, more than one Entry Team may be operating in the Hot Zone at the same time. Line of sight contact among individual Entry Team personnel operating in the Hot Zone must be maintained. Each Entry Team member is to be equipped with a portable radio.

## **BACK-UP TEAM**

A Back-Up Team must be provided to rescue or assist the Entry Team. The Back-Up Team shall be protected with the same level of PPE as the Entry Team, and must always monitor at least one member of the Entry Team when the Entry Team is in the Hot Zone.

The Back-Up Team also will provide backup by staffing appropriate fire suppression equipment and may rotate with the Entry Team at appropriate intervals. Each Back-Up Team member is to be equipped with a portable radio.

It is desirable to have the same number of members in the Back-Up Team as there are in the Entry Team. For large incidents where rescue and medical treatment in the Hot Zone is imperative, more responders in the Hot Zone may be needed. It will be up to the HazMat Group Supervisor and the HazMat Safety Officer to determine the number of members of the Back-Up Team.

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<sup>8</sup> ICS HAZMAT POSITION MANUAL 222-4, 9/91

## **SUPPORT PERSONNEL**

### **MEDICAL GROUP**

Paramedic personnel and EMTs are responsible for the care of rescued or injured persons. They should be familiar with medical procedures specific to the incident. This necessitates their being given accurate, complete information when it becomes available.

Medical personnel may need to establish a triage station, obtain transportation for large numbers of people, and maintain communications with hospitals and the Poison Control Center.

All paramedic personnel on scene should be made aware of any special decontamination procedures or solutions. If a serious injury has occurred to a contaminated person, that person should be decontaminated and treated before transport to the hospital. The paramedics and the receiving hospital must be advised of the hazardous material contacted and the decontamination procedures and solutions used. Decontamination information is available from container labels, reference books, Material Safety Data Sheets, or the Poison Control Center.

HazMat trained and equipped paramedics and EMTs may enter the Warm or Hot Zones to provide medical treatment. Paramedics and EMTs may serve as the Safe Refuge Manager. Paramedics and EMTs who enter the Warm or Hot Zones will have had to receive at a minimum the 24-hour CSTI HazMat Industrial Technician or the 240-hour CSTI HazMat Technician/Specialist Training.

### **TECHNICAL ADVISORS**

Technical advisors alert the Incident Commander to the potential hazards of the materials involved and may recommend possible actions to lessen or eliminate the impact of those hazards to persons and the environment. Technical advice may be obtained from facility managers, manufacturers, distributors, chemists, clean up contractors, or other persons with expertise on the materials or systems involved.

The Incident Commander can confer with technical advisors using a cellular telephone. If on scene advice is required, the Incident Commander can request a technical advisor to respond.





## SECTION 4. PROTECTIVE CLOTHING

The need for proper protective clothing and equipment is obvious, but there is no one protective suit that will satisfy this need for protection under all conditions. Hazardous materials can enter the body by inhalation, absorption, or ingestion.

Positive Pressure Self Contained Breathing Apparatus (PP SCBA) can protect the lungs, gastrointestinal tract and eyes against airborne toxic materials.

Chemical resistant clothing can protect the skin and body systems (blood, nervous, etc.) from contact with toxic chemicals.

Good personal hygiene limits or prevents ingestion of released substances.

A good Site Safety Plan includes proper decontamination procedures and strict enforcement of the "No Smoking, No Eating" rule around hazardous material incident sites.

The US Environmental Protection Agency (EPA) has defined four levels of protective clothing for protection against contact with known or anticipated chemical hazards:

- LEVEL A
- LEVEL B
- LEVEL C
- LEVEL D

### **LEVEL A—ENCAPSULATING CLOTHING INCLUDES:**

1. Positive pressure self contained breathing apparatus
2. Encapsulating gas tight chemical resistant suit
3. Chemical resistant outer gloves
4. Chemical resistant inner gloves (optional)
5. Chemical resistant boots

### **LEVEL B—NON ENCAPSULATING CLOTHING INCLUDES:**

1. Positive pressure self contained breathing apparatus

#### SECTION 4. PROTECTIVE CLOTHING

2. Chemical resistant clothing, a hooded one or two piece chemical resistant splash suit, which may be of the disposable type
3. Chemical resistant outer gloves
4. Chemical resistant inner gloves (optional)
5. Chemical resistant boots

### **LEVEL C—NON ENCAPSULATING CLOTHING INCLUDES:**

1. Full face cartridge respirator
2. Chemical resistant clothing, a hooded, one or two piece chemical resistant splash suit, which may be of the disposable type
3. Chemical resistant outer gloves
4. Chemical resistant inner gloves (optional)
5. Chemical resistant boots

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

San Francisco Fire Department personnel will not normally use level C, as PP SCBA shall normally be used. Air purifying adapters for the Scott face pieces along with combination HEPA/Organic Vapor/Acid Gas cartridges are on the Hazardous Materials Unit. Their use is limited to certain situations where all involved materials are known and they have warning properties, the atmosphere is being continuously monitored, there is at least 19.5% oxygen in the atmosphere, and cartridges are appropriate for the suspected contaminants.

### **LEVEL D—WORK CLOTHES (STRUCTURAL FIRE FIGHTING CLOTHING) INCLUDES:**

1. Positive pressure self contained breathing apparatus
2. Turnout coat and pants
3. Helmet
4. Boots
5. Gloves and hoods

NOTE: Structural fire fighting clothing does not afford the wearer any protection against chemical contact.

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."

A concentration of a toxic substance in the air suggests the use of a fully encapsulating gas tight suit (Level A), but for non airborne concentrations of chemicals, a hooded, high quality chemical resistant suit (Level B) will provide adequate protection.

The selection of either encapsulating suits or non encapsulating suits is a judgment that should be made by qualified personnel. 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.

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 by absorption through the skin
3. No adverse effects would occur if the chemicals contacted the small areas of unprotected skin
4. The air is monitored periodically to evaluate levels of contaminant

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.

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. The Hazardous Materials Group Supervisor shall specify the level of protective clothing for the Hot and Warm Zones.

In assessing potential hazards for personal protective equipment requirements, 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 easy to select the proper level of protective clothing and equipment.

Totally encapsulating chemical protective suits 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.

#### SECTION 4. PROTECTIVE CLOTHING

The level of protection provided by PPE selection shall be increased when additional information on site conditions suggests that increased protection is necessary to reduce employee exposures to below permissible exposure limits and published exposure levels for hazardous substances and health hazards.

NOTE: The level of personnel protection provided may be decreased when additional information or site conditions show that decreased protection will not result in hazardous exposures to employees.

## SECTION 5. OPERATING GUIDELINES

### HAZMAT TEAM FUNCTIONS

The San Francisco Fire Department's HazMat Team will provide technical expertise, equipment, and assistance at the incident and perform duties as directed by the Incident Commander. A quick reference of some of the duties include:

1. Identify and/or confirm initial identification.
  - a. Use more than one source
2. Perform hazard assessment:
  - a. Visualize likely behavior without intervention:
    - 1) Understand, track, and predict the sequence of events.
  - b. Factors governing severity of incident include:
    - 1) Intrinsic properties of the material
      - a) Flammability
      - b) Toxicity
      - c) Instability
    - 2) Dispersive energy of the material:
      - a) Pressure
      - b) Temperature
      - c) State of matter (solid, liquid, gas)
    - 3) Quantity present
    - 4) Size of container
    - 5) Environmental factors:
      - a) Topography
      - b) Weather
    - 6) Population density
  - c. Determine potential harm:
    - 1) Fatalities
    - 2) Injuries (chronic/acute)
    - 3) Critical system disruption
    - 4) Environmental damage
    - 5) Property damage
    - 6) Legal implications
  - d. Monitor area
3. Determine response objectives:
  - a. Team meeting

SECTION 5. OPERATING GUIDELINES

- b. Consult technical references
  - c. Consult with technical experts
  - d. Advise Incident Commander of recommendations/situation
  - e. Interface with other agencies
4. Don protective clothing:
- a. Determine proper level of protective clothing and implement:
    - 1) Level A:
      - a) Encapsulating chemical protective clothing
      - b) Positive pressure SCBA
    - 2) Level B:
      - a) Non encapsulating chemical resistant clothing
      - b) Positive pressure SCBA
    - 3) Level C:
      - a) Non encapsulating chemical resistant clothing
      - b) Cartridge respirators
    - 4) Level D, structural fire fighting clothing:
      - a) Full protective clothing
      - b) Positive pressure SCBA
  - b. Utilize protective clothing, and/or;
  - c. Isolate/evacuate.
5. Establish resource requirements:
- a. Police
  - b. Technical experts
  - c. Special equipment/apparatus
  - d. Clean up contractor.
  - e. Make notifications for other resources.
6. Perform site management, under direction of Incident Commander:
- a. Establish perimeters:
    - 1) Hot Zone:
      - a) Hazardous materials tape.
      - b) Traffic cones/Barricades.
      - c) Ropes
    - 2) Warm Zone:
      - a) Fire line tape
7. Control release:
- a. Safety of personnel and public paramount
  - b. Keep released product to as small an area as possible:
    - 1) Avoid contact with released product or vapors
    - 2) Eliminate ignition sources

- 3) Confine released product:
    - a) Catch in another container
    - b) Dike or dam
    - c) Secure drains
    - d) Contain released product
    - e) Shut off valves
    - f) Reposition containers
    - g) Plug or patch openings
  - 4) Cover to suppress vapors/hold down solids
  - 5) Absorb water soluble vapors with water fog
8. Decontaminate personnel and equipment exiting Hot Zone:
    - a. Establish Decontamination Corridor:
      - 1) normally within the Warm Zone
    - b. Conduct medical evaluation
    - c. Arrange for medical follow up
  9. Terminate incident:
    - a. Interface with cleanup personnel
    - b. Critique

The following are recommended operating guidelines for first responders to incidents involving hazardous materials. When hazardous materials are known to be involved, the first responder should immediately request the HazMat team to respond.

At fixed facilities, the first responder should request a copy of the facility emergency response plan and material safety data sheets for the materials involved or stored in the incident area. Emergency Communications Department (ECD), Battalion 2, and the DPH Emergency Responder have a list of hazardous materials storage facilities. The list includes a summary of the hazardous materials on-site and the emergency contact.

When the responsible party of the spilled materials is known, that party is responsible for all costs incurred for the proper cleanup and disposal. The recovered material, including any contaminated absorbents, diking material and disposable clothing are to be left with the responsible party for proper disposal.

When the responsible party is known, but the party is unavailable, or when the responsible party of the spilled materials is not known and clean up and disposal action must be initiated and the HazMat Team has responded and determines the need for clean up and disposal, the representative from the Department of Public Health will secure the clean up and disposal contractor.

## **ASBESTOS DECONTAMINATION**

### **Operating Guidelines**

Decontamination procedures for asbestos removal from firefighters shall be implemented if the Incident Commander deems them necessary. The Incident Commander should consult with the DPH Emergency Responder for assistance. Potentially contaminated fire fighting equipment shall be decontaminated at the scene by washing or using the HEPA vacuum cleaner. A HEPA vacuum for asbestos is available on the HazMat Unit. When it is determined that decontamination is necessary, the following procedures shall be implemented.

### **Contaminated Dry Clothing**

If possible, use a HEPA vacuum to remove asbestos fibers from the clothing while it is still worn. Both the individuals being vacuumed and those performing the vacuuming should wear a SCBA. The clothing should then be carefully placed into a plastic bag. The bag should be sealed and labeled with the name of the person(s) to whom the clothing belongs, the incident number, and the date.

### **Contaminated Wet Clothing**

Before taking the clothing off, thoroughly rinse it. Then take the clothing off, rinse it again, and then place it in a plastic bag. Seal the bag, and label it as described above.

### **Showers**

Members should shower themselves thoroughly. This should be done at the scene if possible, or immediately upon return to their station. If the incident occurs at an asbestos abatement operation, members may utilize the shower utilized by the asbestos abatement workers.

### **Clothing**

The Incident Commander is responsible for the decontamination of all members. Members will be furnished with clothing as arranged by the Incident Commander for their return to the station.

If the above procedures are not possible, the clothing and equipment shall remain at the scene. The party or parties responsible for the premises will decontaminate the bagged clothing and equipment that remains at the scene. If this is not possible, clothing shall be carefully placed in a washing machine and laundered. Equipment shall be vacuumed with the HEPA vacuum cleaner.



Implementation of decontamination procedures does not necessarily indicate that SFFD members have been exposed in excess of the permissible exposure level of 0.2 fibers per cubic centimeter in an 8-hour time weighted average or the action level of 0.1 fibers per cubic centimeter of air.

DPH Environmental Health Section will answer any questions or concerns of exposure.  
Pager: 252-3855.

## **TERRORISM INCIDENTS**

### **Defining Terrorism**

The FBI defines terrorism as “the unlawful use of force against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.”

Domestic terrorism involves groups or individuals whose terrorist activities are directed at elements of our government or population without foreign direction.

International terrorism involves groups or individuals whose terrorist activities are foreign-based and/or directed by countries or groups outside the United States or whose activities transcend national boundaries.

### **On-Scene Warning Signs**

When approaching a scene that may involve criminal or terrorist activity involving CBRNE (Chemical, Biological, Radiological, Nuclear, Explosive) agents, the most critical consideration is the safety of oneself and other responders. Be cognizant that the presence and identification of hazardous agents may not be immediately verifiable, especially in the case of biological agents.

When arriving on-scene, be alert for signs indicating a suspicious incident. Unexplained patterns of illnesses or deaths can be due to radiological, biological, or chemical agents. Indicators of possible criminal or terrorist activity involving chemical agents include:

1. The presence of hazardous materials or laboratory equipment that is not relevant to the occupancy
2. Intentional release of hazardous materials
3. Unexplained patterns of sudden onset of similar, non-traumatic illnesses or deaths. Pattern may be geographic, by employer, or associated with agent dissemination methods
4. Unexplained odors or tastes that are out of character with the surroundings

## SECTION 5. OPERATING GUIDELINES

5. Multiple individuals exhibiting unexplained signs of skin, eye, or airway irritation
6. Unexplained bomb/munitions like material, especially if it contains a liquid
7. Unexplained vapor clouds, mists, and plumes
8. Areas that look different in appearance. Not just a patch of dead weeds, but trees, shrubs, bushes, food crops, and/or lawns that are dead, discolored, or withered. (No current drought.)
9. Surfaces exhibiting oily droplets/films. Unexplained oily film on water surfaces
10. An abnormal number of sick or dead birds, animals, and/or fish
11. Unusual security, locks, bars on windows, covered windows, and barbed wire

### **CHEMICAL WARFARE AGENTS—SPECIFIC INDICATORS**

A chemical incident is characterized by a rapid onset of medical symptoms (minutes to hours) and may have observed signatures such as colored residue, dead foliage, pungent odor, and dead insect and animal life. Exposed victims may exhibit the following symptoms: unexplained health problems such as nausea, vomiting, twitching, tightness in chest, sweating, pin point pupils (miosis), runny nose (rhinorrhea), disorientation, difficulty breathing, convulsions, or death. The presence of a suspicious substance, or aerosolizing device may also be an indicator of a chemical warfare agent.

### **BIOLOGICAL AGENTS—SPECIFIC INDICATORS**

Indicators of possible criminal or terrorist activity involving biological agents include:

1. Unusual disease outbreak in humans or animals, especially resulting from one of the CDC Category A, B or C bioterrorism agents. Any number of symptoms may occur. The time required before symptoms are observed is dependent on the agent used, but usually requires days to weeks. Report suspected cases to the Communicable Disease Control and Prevention Section of SF DPH at 554-2830
2. Health care facilities reporting multiple casualties with similar signs or symptoms
3. Unscheduled or unusual spray being disseminated, especially if outdoors during period of darkness
4. Abandoned spray devices. Devices will have no distinct odors.
5. Visible contamination with a suspicious powder or substance, especially when accompanied by a credible threat
6. Positive signal from stationary bioterrorism detection systems, such as BDS at United States Postal Service, or Biowatch (various locations)

With covert biological incidents, the onset of symptoms usually requires days to weeks and there are typically no characteristic signatures because biological agents are often odorless and colorless. The area affected may be greater due to the migration of infected individuals because of the delayed onset of symptoms. An infected person may transmit the disease to another person.

Overt biological incidents would include some visible evidence (aerosolizing devices, or suspicious powders) and should also be screened for potential radiological, chemical, and explosive compounds, before being treated as a potential bioterrorism agent. Response actions can include victim decontamination, post-exposure prophylaxis, and facility restoration.

## **RADIOLOGICAL INCIDENT—SPECIFIC INDICATORS**

Indicators of potential radiological or nuclear devices could include:

1. Potential ordnance/munitions like device, particularly one that exhibits signs of shielding, or containing heavy solids (via EOD evaluation)
2. Unexplained presence of gamma radiation detected by personal dosimeters
3. Unexplained report(s) of radiation sickness
4. Any explosion

### **Recognition**

Upon recognition of a terrorist incident that includes HAZMAT or a CBRNE event (a yellow alert, multi-casualty incident will be issued), the Communications Center must be notified to dispatch the Metropolitan Medical Task Force (MMTF) which consists of the following units:

- First due Division Chief
- Battalion 2
- HazMat 1, staffed with Engine 36 crew
- Rescue Squad 1
- Rescue Squad 2
- Engine 1
- Engine 7
- Truck 1
- Truck 7
- Rescue Captain 3
- Mobile Air 1
- Mass Casualty Unit
- MMRS HazMat Support Unit
- 4710 Bureau of Fire Investigation

## SECTION 5. OPERATING GUIDELINES

- Bureau of Equipment
- DPH Environmental Health Emergency Responder
- SFPD EOD (bomb squad)
- Safety Officer

The evolution of an MMTF response will usually build over the course of the incident. The exception is an Anthrax alarm at the US Postal facility on Evans Street, which will automatically trigger a full MMTF initial response.

The following actions/measures in this section to be considered by first responders are applicable to either a radiological, chemical or biological incident. The guidance is general in nature, not all encompassing, and its applicability should be evaluated on a case-by-case basis by the first responders.

## **CHEMICAL FIRES**

### **Operating Guidelines**

**WHEN FIGHTING FIRES IN HOSPITALS, LABORATORIES, OR OTHER AREAS SUSPECTED OF CONTAINING CHEMICALS, THE FOLLOWING GUIDELINES SHALL BE NOTED:**

### **Protective Equipment**

Due to the confinement of liquids and airborne smoke, fumes, and vapors, all fire fighting personnel shall wear positive pressure self contained breathing apparatus and full protective fire fighting clothing to all reported fires including facilities known or suspected of using or storing hazardous materials.

Full protective fire fighting clothing includes gloves, helmet, hood, turnout coat, turnout pants, and turnout boots.

These facilities include, but are not limited to: hospitals, laboratories, plating shops, or facilities marked with the NFPA 704 marking as required by the San Francisco Department of Public Health.

### **Hose Streams**

Narrow streams should not be aimed directly at chemical containers and glassware as the containers may be washed off the shelf or table and broken. If available, combination nozzle-fog streams should be used. When possible, personnel, hoses, and equipment should not contact released liquids from chemical related incidents.

**Information**

Personnel are not to enter rooms with hazard markings on doors until information is secured about the hazard(s) within the room and evaluation of dangers and risks to firefighters has been made.

**Radioactivity**

When radioactive markings are present, the area should be monitored for radioactivity before entry is made by fire fighting personnel. If engine companies have received radiation dosimeters, they can be used to monitor gamma ionizing radiation. Radiation survey instruments are also available on HazMat and Rescue Company rigs.

**Personnel**

Personnel entering the area of fire involvement shall be only those personnel necessary to effect extinguishment. They should limit their exposure time as much as possible by exiting the area as soon as extinguishment is accomplished. Ventilation should be performed as soon as possible and from the exterior whenever possible.

**Decontamination**

Upon exiting the area, personnel suspected of extensive exposure to airborne contaminants or direct contact with liquids or solids should be decontaminated. Decontamination can be as simple as washing off with water, but may require the removal of clothing and equipment, bagging of that clothing and equipment for later analysis and/or decontamination, and personnel scrubbing with soap and water or another appropriate solution. The extent of decontamination will depend on the extent of contact with hazardous materials and the properties of the hazardous materials involved.

**Exposure Notification**

All personnel suspected of extensive exposure to chemicals shall be advised of the symptoms of exposure, shall be monitored for the effects of exposure, and shall be sent to a medical doctor, if necessary.

**Hazmat Unit**

The Hazardous Materials Unit should be requested for all known incidents involving laboratories or areas of chemical use or storage. If the Hazardous Materials unit has been requested, chemical resistant clothing is available for use by personnel performing overhaul operations and the arson investigators.

In cases of suspected arson or when an investigation by the Bureau of Fire Investigation is required, overhaul operations must be delayed, and the investigators must be advised of the potential for chemical exposure. The fire area and areas of

smoke contamination should be ventilated prior to conducting investigation and overhaul operations.

### **Overhaul**

To avoid additional exposure to fire personnel, overhaul operations should be kept to the minimum. At the Incident Commander's discretion, representatives from the facility may be allowed to survey the area and identify any hazardous materials/wastes and, when appropriate, remove that material. The facility will be responsible for the disposal of hazardous waste.

### **Washing**

All personnel that have responded to fires involving chemicals or other chemical emergencies that have had any exposure to airborne contaminants shall, upon return to quarters, remove their protective clothing and wash that clothing off with soap and hot water as per the Department's cleaning guidelines for protective clothing. They shall also shower, washing any exposed portion of their body (neck, ears, etc.) at least three times with soap and warm water. If the protective clothing was contaminated with hazardous materials, isolate and bag the equipment per Department practices and procedures. If possible, identify the contaminant. Contact the Hazardous Materials Team and have them determine if the contaminant is a true HazMat situation. If so, bring the bagged equipment and MSDS or identity of contamination when available to the Clothing Depot for decontamination by an outside cleaning contractor.

### **Report**

An exposure report shall be submitted for all exposed personnel.

## **CHEMICAL AND CHEMICAL WARFARE AGENT DECONTAMINATION**

### **Operating Guidelines**

**WHEN FIGHTING FIRES IN HOSPITALS, LABORATORIES, OR OTHER AREAS SUSPECTED OF CONTAINING CHEMICALS, OR IF THE PRESENCE OF CHEMICAL WARFARE AGENTS ARE SUSPECTED, THE FOLLOWING SPECIAL DECONTAMINATION PROCEDURES SHALL BE FOLLOWED:**

Many toxic industrial chemicals and all chemical warfare agents require immediate gross decontamination, followed by technical decontamination. For chemical agents, timely and effective removal is critical, so emergency decontamination should begin with the first responding engine company. First responders should remove victims' contaminated clothing and flood exposed skin with copious amounts of water. Follow this with soap and water washing as soon as it is available, repeating as necessary, until symptoms subside.

Every effort shall be made by HazMat to identify the type of agent so that decontamination and medical treatment can be administered effectively. HazMat detection instruments are capable of identifying chemical warfare agents by type. Once the agent category is identified, victims should be prioritized based on whether or not they are exhibiting symptoms for that agent. Following decontamination, information on medical treatment (including supportive care and pharmaceutical caches) can be obtained from the DPH EMS Duty Officer on call.

Specialized decontamination solutions for chemical agents may be recommended as needed, to include a dilute sodium hypochlorite (bleach) solution, Sandia foam, and RSDL. For mustard agents and organophosphorous agents a dilute sodium hypochlorite solution may be effective at neutralizing the corrosive properties of the agents. Because sodium hypochlorite can be irritating to the skin, this solution is not recommended for personnel decontamination, but it has demonstrated effectiveness for cleaning facilities and equipment. Sandia foam and RSDL packets are only available at SFO. If Sandia foam or RSDL packets can be made available, they may be used at the discretion of the Hazmat Group Supervisor. Manufacturer's instructions should be followed regarding proper application and contact time. To avoid irritation, rinse treated areas thoroughly with water after use.

### **Exposure Notification**

All personnel suspected of extensive exposure to chemicals shall be advised of the symptoms of exposure, shall be monitored for the effects of exposure, and shall be sent to a medical doctor.

### **Report**

An exposure report shall be submitted for all exposed personnel.

## **RADIOLOGICAL DECONTAMINATION**

### **Operating Guidelines**

If personnel are suspected of having radioactive contamination, thoroughly check all personnel with radiation survey instruments. If readings are above 2 times background levels, personnel/victims should be considered contaminated. If contamination is found on clothing, remove clothing (taking care to protect airway by having victim wipe face then don surgical mask), wipe (see Waterless Decontamination methods described below) or wash exposed skin, and repeat survey. If additional contamination is detected, perform full technical decontamination by scrubbing with soap and water solution and rinse. Survey personnel/victim again, and if contamination is found, repeat cycle two more times. If victim cannot be decontaminated after three soap and water washings,

attempt to decontaminate orifices (mouth, eyes, nose, ears) and/or wounds by irrigation. Remove shrapnel with forceps. Transfer patient to designated treatment facility.

For large scale radiological incidents, wet wipes, disposable clothing, and personal decontamination kits are available at the SFFD warehouse. Wet wipes are preferred over a water rinse for the initial radiation decontamination, in order to minimize contaminated run off and to enable better performance of the survey meters. In addition, each incident involving radiation is to be evaluated for further action by an interdisciplinary team including radiological health experts, medical doctors and industrial hygienists.

For many radiological incidents, contamination is primarily in the form of surface contamination with radioactive dust, which rarely results in life threatening exposures. Persons with radioactive contamination and open wounds are at the highest risk of exposure and should be prioritized for decontamination. Victims with critical injuries should receive medical treatment prior to decontamination. If contaminated wounds are found, paramedics should assume that internal contamination has occurred, and report it to the Safety Officer (who should report it to the DPH EMS Duty Officer on call). DPH HazMat has the ability to identify radioisotopes from unknown sources in the field, which can be useful in prescribing appropriate medical treatment after radiation exposures. Radioisotope information should be reported to the DPH EMS Duty Officer on call.

St. Francis Hospital has been designated as the hospital for treatment of victims exposed to radiation, and is equipped to perform onsite decontamination.

## **BIOLOGICAL DECONTAMINATION**

### **Bioterrorism Agents**

Dermal exposure to most biological warfare agents can be effectively treated by washing with soap and water. The combination of physical removal and neutralization by standard hand soap has been found to be the most effective combined treatment against bacteria, viruses, biotoxins, and spores.

Depending on the nature of the threat and the likelihood of exposure, gross and or technical decontamination may be recommended for high risk bioterrorism scenarios (see following sections). For low risk or low probability scenarios, decontamination recommendations could include use of wet wipes (see section on Waterless Decontamination) followed by showering at home (for ambulatory victims). Consideration for weather conditions, the number of possible victims, and available resources should be made when deciding on the appropriate decontamination measures for the incident.



Additional consultation and information on response actions for bioterrorism agents can be provided by DPH HazMat (252-3855) and DPH CDCP (554-2830).

### **Bio-Medical Contamination**

If bio medical contamination is suspected, wash suspected personnel three times with soap and water. Rinse personnel thoroughly between washings. Remove all clothing and bag for future additional cleaning.

## **EMERGENCY DECONTAMINATION**

### **Operating Guidelines**

Whenever a liquid, solid, or gaseous substance of unknown properties or suspected hazardous properties contacts victims, a decontamination procedure **MUST** be carried out immediately.

Examples of circumstances requiring immediate decontamination procedures include contaminated civilians, firefighters, other responders, and when the protective suit of a HazMat Team member has failed.

To protect the ambulance crew, hospital staff, and the victim, every attempt must be made to do at least these emergency procedures before transporting the victim. Whenever possible, a thorough field decontamination procedure, as described in the previous section, should be done before transporting.

Ideally, the following procedures would be performed in the sequence outlined. However, action steps initiated by the officer in charge can be adjusted to expedite the situation when conditions warrant.

### **General Guidelines**

The procedures outlined should be carried out as quickly as possible.

1. Properly attired firefighters remove the victim from the contaminated area. Take all precautions to avoid direct contact with the hazardous material or the contaminated areas of the victim.
2. Immediately wash any contacted or suspected area of contact on the victim with flooding quantities of water using low pressure and a spray pattern. Provide special attention to the washing of open wounds. Speed is important with injuries, but even then decontamination should be as thorough as is practical.

## SECTION 5. OPERATING GUIDELINES

If the rescuer has contacted the contaminant during rescue, that portion of his/her body and any contaminated clothing should be flooded with water while attending to the victim.

If personnel and equipment are available, runoff water should be contained.

3. If the victim is wearing an SCBA, release the harness and remove the equipment, leaving the facemask in position.
4. Carefully remove contaminated clothing and jewelry. Avoid additional contact between the victim and the contaminant. Continue washing the victim while removing his/her clothing. Remove the facemask. All contaminated articles should be placed in a plastic bag or container and marked with the victim's name.
5. Render first aid as required. If the contaminant is a gas, immediate concern should be for the respiratory system for victims that were not wearing breathing apparatus.  
Do not apply mouth to mouth resuscitation. Administer oxygen continuously to aid these victims in flushing the respiratory system and to minimize the need for deep breathing. Notify the paramedics or send the victim for medical treatment when possible.
6. Inform the ambulance personnel or hospital of the contaminant involved and the procedures taken for decontamination.
7. Keep all removed clothing and equipment isolated for further actions by the HazMat Team.

### **Prioritizing Casualties For Decontamination**

Historically, mass casualty incidents involving radiological or chemical contaminants result in a ratio of five individuals who presume they have been exposed (also called walking wounded) for every one actual exposed casualty. This implies that for every one casualty with an exposure that requires decontamination and/or medical treatment, five others will require evaluation, and that there will be a large number of mobile and vocal potential casualties demanding rapid assessment and treatment. As a result, casualties must be prioritized for decontamination in order to conserve resources of First Responders.

Ambulatory victims should be prioritized for decontamination in accordance with basic medical field triage guidelines. Medical triage should be based on presenting complaint and rapid physical assessment into the following categories. The triage evaluation shall include both medical symptoms that match exposure, and conventional injuries or medical conditions not related to exposure.

1. **Immediate** (requiring medical care within one hour).

2. **Delayed** (capable of having medical treatment delayed until all Immediate patients have been decontaminated and treated).
3. **Minimal** (not requiring medical treatment for several hours). Minimal patients should be evaluated periodically, but can be prioritized for decontamination as follows:
  - a. Casualties closest to the release
  - b. Casualties who report exposure to vapor or aerosol, or who have open wounds and visible contamination
  - c. Casualties with evidence of deposits on clothing or intact skin (visible contamination)
  - d. Casualties with serious medical symptoms that match exposure
  - e. Casualties with conventional injuries not related to exposure
4. All other patients and **Expectant** (fatally injured) patients.
5. **Expired** patients are not decontaminated until other patients have been cared for and will be decontaminated at the direction of the Medical Examiner.

## TECHNICAL DECONTAMINATION

### Operating Guidelines

Technical decontamination may be recommended as a secondary step to either gross or waterless decontamination. It also may be required whenever more thorough decontamination is required, such as when acute and persistent health symptoms associated with the exposure are observed, or visible contaminant residue is present.

Technical decontamination includes head-to-toe wetting in a systematic fashion using soap followed by rinsing with warm water. The Decontamination Team is responsible for delivering, setting up, and staffing the technical decontamination equipment. **Any member of the Department may be assigned to the Decon Team.** For small incidents, the DQE Showers and collection pools on HazMat 1 may be adequate. When large numbers of victims require technical decontamination, the TVI tents with warm water shower corridors may be required. If the TVI tents are available, victims should be directed to them. The TVI tent has two private decontamination corridors, which can be used for gender segregation, or to accommodate ambulatory and non-ambulatory victims. The TVI tent has two shower heads on each decontamination line, one for soapy water and one for rinse water. Warm water is provided by a flow through a water heater. Non-ambulatory victims should be decontaminated by members of the Decon Team on stretchers using the patient conveyor.

After washing with soap and water, victims should dry off using towels provided, and don Tyvek coveralls. Blankets for warmth are also available. If the TVI equipment is set up, the HazMat DQE showers should be reserved for First Responders. The HazMat DQE showers do not provide warm water, and require that soap be applied with sponges and brushes.

## **WATERLESS DECONTAMINATION**

### **Operating Guidelines**

For radiological or certain biological contaminants, waterless decontamination may be recommended. A cache of body wipes and shampoo caps are stored at BOE for this purpose. HazMat may request delivery of these materials to an appropriate contamination reduction area. The benefits to waterless decontamination are as follows: it is a fast and efficient way for ambulatory individuals to decontaminate themselves, reducing waiting time and freeing up first responders to assist those in need; it reduces the amount of contaminated wash water that could flood the decon area; and it is recommended by radiation experts as an initial decontamination step for radiological contamination.

Individuals should be directed to remove outer clothing and wipe areas of exposed skin, using a clean wipe for each area of the body: hands, face, head, neck, arms, legs, and then hands again. Due to concern about possible exposure of a victim's airway during decontamination, the Decontamination Team may be able to provide victims with surgical masks for airway protection when removing clothing. For a biological agent, follow up actions may include prophylaxis and showering at home. For a radiological incident, onsite screening shall be conducted by first responders before individuals may leave the site. Individuals that cannot remove radiological surface contamination using waterless wipe methods should follow it by Technical Decontamination. More specific guidelines on radiation decontamination are provided in the CCSF Terrorism Incident Annex to the Emergency Operations Procedure.

## **HAZMAT RESCUE**

### **Operating Guidelines**

Normal HazMat operating procedures call for deliberate preparations for a hazardous materials entry into a contaminated area. In a life-saving situation, these protocols can delay entry such that the rescue attempt becomes unsuccessful. In order to speed up response into the contaminated Hot Zone, the Incident Commander along with the Hazardous Materials Group Supervisor can initiate HazMat Rescue Protocols.

### **Recognition and Evaluation**

Upon recognition that a hazardous material incident or WMD incident is occurring, the first arriving officer will activate the Hazardous Materials Team or Metropolitan Medical Task Force (MMTF). If the Incident Commander determines that there are victim(s) in the contaminated area that need immediate extrication, the Incident Commander will contact the Hazardous Materials Group Supervisor. The Incident Commander will provide all the information on the incident that is available. The Incident Commander and the Hazardous Material Group Supervisor will evaluate the situation. Besides the need for the rescue, the IC and HMGS will evaluate the risk to the Entry Team if a HazMat Rescue is initiated. If the IC and HMGS both agree that a HazMat Rescue is needed, HazMat Rescue Protocols will be initiated.

### **HazMat Rescue Protocols**

1. Incident Commander is assigned.
2. Safety Officer is assigned.
3. Enroute, HazMat Team is notified that HazMat Rescue Protocols will be used. HazMat Team will prepare suits, boots, SCBAs, radios, stretchers or skeds, and air monitoring equipment, if needed. Level A encapsulating suits will be utilized, unless it has been determined that lower level of protection is adequate. HazMat Team will be provided all available information on the incident, including agents involved and hazards from the agents.
4. Contact IC on scene and make sure that decontamination is set up. This can mean setting up a hose line from an engine.
5. Upon arrival at the scene, two responders will don SCBAs, chemical suits, gloves, boots and radios. They will be the Entry Team.
6. Two other responders will don same equipment. They will be Back-up Team.
7. Entry and Back-up Teams will be given quick briefing from HMGS.
8. Entry Team will make needed rescue, moving victim(s) to safe area, and then back out. HazMat Team and others can then regroup and deal with mitigation.

SECTION 5. OPERATING GUIDELINES

## SECTION 6. APPENDICES

### APPENDIX A—DOT HAZARD CLASS

In some of the procedures for the DOT hazard classes, a distinction is made for bulk or non-bulk packaging. Non-bulk packaging means:

- A packaging which has an internal volume of 119 gallons or less for liquids
- A capacity of 882 pounds or less or an internal volume of 119 gallons for a solid
- A water capacity of 1000 pounds or less for a gas

The United Nations has divided hazardous materials into the following hazard classes. The United Nations hazardous class number is the small number on the bottom corner of placards and labels. The classes are:

- Class 1 - Explosives
- Class 2 - Compressed Gases
- Class 3 - Flammable Liquids
- Class 4 - Flammable Solids
- Class 5 - Oxidizers
- Class 6 - Poisons
- Class 7 - Radioactives
- Class 8 - Corrosives
- Class 9 - Miscellaneous Hazardous Materials
- ORM D - Other Regulated Materials

Miscellaneous hazardous materials are materials which present a hazard during transport, but which are not included in any other hazard class (PCBs). ORM-D materials (consumer commodity) present a limited hazard during transportation due to their form, quantity and packaging.

The following procedures use the United Nations classifications for determining the appropriate procedures.

## **CLASS 1—EXPLOSIVES**

### Operating Guidelines

#### **Definition**

An explosive is any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion, which will occur with an instantaneous release of gas and heat. (Rockets, grenades, bombs, flash powders, propellant explosives, small arms ammunition, and common fireworks.)

A blasting agent is any material designed for blasting that has been tested and has been found to be so insensitive that there is little probability of accidental initiation to explosion. (Mixture of ammonium nitrate and fuel oil.)

#### **General Information**

1. Identify the material(s) involved.
2. Keep non-essential people away. (This includes non-essential emergency service personnel.)
3. Establish control zones. (Isolate area and deny entry.)
4. Extinguish all sources of ignition in the vicinity. Do not allow vehicles or other sources of ignition in the area.
5. Wear positive pressure SCBA and full protective clothing.
6. Avoid exposure to smoke, fumes, vapors, dust, or direct contact. The products of combustion of some propellant explosives are poisonous.
7. Do not allow personnel to touch or move explosives. Explosives should be moved only under the advice and supervision of trained explosive personnel.
8. Contact San Francisco Police Department Explosive Ordinance Disposal (EOD) (Bomb Squad) for assistance, through SFPD Operations ( 553-1071)
9. When the HazMat Team (HMT) is requested to respond to a bomb threat involving hazardous materials, under no circumstances will the HMT conduct building or area searches even when hazardous materials are involved. The HMT will stage in a safe area, but in no case less than 600 feet from the incident scene. The HMT will act as a technical resource for the Bomb Squad. This may involve the loaning of chemical protective clothing to Bomb Squad personnel, assistance in dressing, researching chemical data, etc.

#### **Fire Conditions**

1. DO NOT FIGHT FIRE IN CARGO OR STORAGE AREAS CONTAINING EXPLOSIVES. Withdraw from the area and let the fire burn.



2. If a fire is near explosives, efforts should be made to prevent the fire from reaching the explosives. For fires involving the motor, cab, or tires of vehicles transporting explosives, flood the involved area with water.
3. The application of water to burning Class A or Class B explosives may cause an explosion.
4. EVACUATE AREA: Class A Explosives - 1/2 mile in all directions; Class B Explosives - 1/2 mile in all directions; Class C Explosives - 1500 feet in all directions; Blasting Agents - 1/2 mile in all directions
5. Do not overhaul areas where explosives have burned or exploded.
6. Explosives that have been exposed to heat may be very shock sensitive. Keep all personnel away and do not move these containers.
7. When explosives are involved in fire or serious accidents on the railroad, the Bureau of Explosives (202) 835-9500 should be notified.

## **CLASS 2—FLAMMABLE GASES**

### Operating Guidelines

#### **Definition**

A material or mixture having a vapor pressure exceeding 40 psi absolute at 100°F, and either a mixture of 13% or less (by volume) with air forms a flammable mixture or the flammable range with air is wider than 12% regardless of the lower limit. (Hydrogen, propane)

#### **General Information**

1. Identify the material(s) involved.
2. Keep non-essential people away. (This includes non-essential emergency service personnel.)
3. Establish control zones. (Isolate area and deny entry.)
4. Stay upwind and keep out of low areas.
5. Ventilate confined areas before entering.
6. Wear positive pressure SCBA and full protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for all incidents. In some cases chemical protective clothing carried by the HazMat Team will be required for the safe handling of the incident.
7. Avoid exposure to gas.
8. Since the application of water to pools of liquefied gas will increase the vaporization rate, this is not usually a recommended practice.
9. If a tank truck or tank car is involved in fire, isolate 1/2 mile in all directions.
10. Determine and implement appropriate decontamination procedures for personnel and equipment.

11. Consult CHEMTREC (800 424-9300) for product information and assistance.

### **Fire Conditions**

1. Do not extinguish the fire unless the flow of gas can be stopped. The recommended means of extinguishing is to stop the flow.
2. If a leaking tank is involved in a fire, cooling the tank with water may reduce the internal pressure and the rate of leakage. If sufficient water is available, use water spray to cool the tanks and adjacent combustibles affected by the heat of the fire. For massive fires, use unmanned monitors. If this is not possible, withdraw from the area and let the fire burn.
3. Uninsulated pressure tanks may rupture violently if there is flame impingement on the vapor space at the top of the tank.
4. If it can be done safely, remove any vehicles or containers not already burning.
5. Let tank car, tank truck, or storage tank burn unless leak can be stopped.
6. Stay away from the ends of tanks exposed to heat or flame impingement.
7. Observe tanks for evidence of bulging or red hot spots in the metal, and listen for a rising sound from venting safety devices. These indicate that the tank may fail.

### **Spill or Leak**

1. Extinguish all sources of ignition in the vicinity (traffic light control boxes, machinery, tar pots, etc.).
2. Flammable gases may be heavier or lighter than air. Determine the vapor density of the material from reference sources and use combustible gas indicators to determine the boundary of the gases. Survey the areas where gases are likely to accumulate. (Acetylene, ammonia, ethylene (ethene), hydrogen, hydrogen cyanide, methane, and natural gas are lighter than air flammable gases.)
3. Flammable gases may ignite and flash back to the opening from which the gas originated.
4. Do not allow vehicles or other sources of ignition in the area as long as the combustible gas indicator indicates the presence of flammable gases.
5. Do not enter the gas cloud. Be aware that the flammable gases extend beyond any visible clouds.
6. Water spray can be used to absorb water miscible gases, and water spray or explosion proof fans can be used to disperse gas clouds. Do not get water inside containers. Run-off must be contained for later analysis and possible disposal. Do not permit the run-off to enter storm, sewer, or water systems.

7. If it can be done safely, locate all leaks and close valves or use other methods to reduce the amount of leakage.
8. If it can be done safely, move undamaged containers to a safe area, being careful to avoid sparks or friction.
9. Post guards and keep spectators at least 2500 feet away from leaks from tank cars, tank trucks, or large storage tanks containing compressed gas, liquefied gas, and cryogenics.
10. Wrecking operations or transfer of product should not begin until all the gas is dispersed. Confirmation of gas dispersal should be done with a combustible gas indicator.
11. To prevent the build-up of static electricity, bond and ground containers and equipment before product transfer.
12. Cutting torches or spark generating saws must not be used on the shell of empty or loaded cars or containers.
13. Empty tanks or tanks containing residue should be regarded as containing an ignitable gas air mixture.

## **CLASS 3—FLAMMABLE LIQUIDS**

### Operating Guidelines

#### **Definition**

Liquids having a flash point below 100°F. (Alcohol, ether, gasoline, and toluene.)

#### **General Information**

Identify the material(s) involved.

1. Keep non-essential people away. (This includes non-essential emergency service personnel.)
2. Establish control zones. (Isolate area and deny entry.)
3. Stay upwind and keep out of low areas.
4. Eliminate ignition sources.
5. Ventilate confined areas before entering.
6. Wear positive pressure SCBA and full protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for all flammable liquid incidents. In some cases chemical protective clothing carried by the HazMat Team will be required for the safe handling of the incident.
7. Avoid exposure to smoke, fumes, vapors, or direct contact.
8. If spilled material has entered storm, sewer, or water systems, notify the Wastewater Treatment Plant Chief Operator. Maps should be used to determine the direction of flow and destination (outflow) of the system. Consideration should be given to diking the storm, sewer, or water system

- ahead of the flow or at Pump Stations. It may be appropriate to apply foam not only at the spill site, but also into the storm, sewer, or water system.
9. To lessen the chances of ignition, it may be advisable to apply foam ahead of the flowing spill, either into storm drains or manholes down-flow from the spill, or down-flow on the surface of open storm, sewer, or water systems.
  10. If a tank truck or tank car is involved in fire, isolate 1/2 mile in all directions.
  11. Most flammable liquids float on water. Therefore, the application of water to a spill area may enable the flammable liquid to spread beyond the boundaries of the original incident.
  12. The vapors of all flammable liquids are heavier than air. Therefore, in addition to eliminating ignition sources in the immediate spill area, the downwind area and adjacent low areas should be checked for sources of ignition and accumulations of flammable vapor.
  13. Consider the need for additional resources and equipment. (diking material, absorbents, foam, overpack containers, transfer equipment, private clean-up contractors, etc.)
  14. Request sufficient foam supplies.
  15. Determine and implement appropriate decontamination procedures for personnel and equipment.
  16. Consult CHEMTREC (800 424-9300) for product information and assistance.

### **Fire Conditions**

1. For small fires, use dry chemical, CO<sub>2</sub>, the appropriate foam or water spray.
2. For large fires use the appropriate foam or water spray. Water may be ineffective on low flash point flammable liquids.
3. If sufficient water is available, use water spray to cool tanks and adjacent combustibles affected by the heat of the fire. For massive fires, use unmanned monitors. If this is not possible, withdraw from the area and let the fire burn.
4. If it can be done safely, remove any vehicles or containers not already burning.
5. Dig trenches or build dikes in the path of the burning liquid to confine the fire and protect exposures.
6. If vapors are burning at the valves, do not extinguish the fire unless re-ignition can be prevented.
7. Observe tanks for evidence of bulging or red hot spots in the metal. Listen for pinging sounds or loud noises from the tank that increase in intensity. Withdraw immediately in case of rising sound from venting safety device or discoloration of tank. These indicate that the tank may fail.

8. Do not puncture or rupture the shell of a transport vehicle involved in a fire as this may liberate more flammable liquid and extend the fire.
9. If safety relief valves are obstructed, try to reposition the tank to allow the valves to function properly.

### **Spill or Leak**

1. Extinguish or eliminate all sources of ignition in the vicinity (traffic light control boxes, machinery, tar pots, etc.). Use combustible gas indicators to determine the boundary of the vapors.
2. Do not allow vehicles or other sources of ignition in the area as long as the combustible gas indicator indicates the presence of flammable vapors.
3. Keep oxidizing materials away from spilled flammable liquids.
4. Post guards and keep spectators at least 2500 feet away for leaks from tank cars, tank trucks or large storage containers.
5. Dig trenches or build dikes ahead of the flow to confine the spill for later disposal or recovery.
6. Do not permit flammable liquids to enter storm, sewer, or water systems.
7. Cover flammable liquids with appropriate foam to blanket the surface and reduce the rate of evaporation. When ambient temperatures are less than 1000° F, combustible liquids will usually not require blanketing to reduce vapors. Do not permit the run-off to enter storm, sewer, or water systems.
8. Water spray can be used to absorb water miscible vapors, and water spray or explosion proof fans can be used to disperse vapors. Do not get water inside containers. Run-off must be contained for later analysis and possible disposal. Do not permit the run-off to enter storm, sewer, or water systems.
9. If it can be done safely, close valves, plug, or reduce the amount of leakage.
10. Since most flammable liquids float, for leaks near the bottom of a tank, water may be added to the tank to float the flammable liquid if the leak cannot be controlled or stopped. The water flow can be adjusted so only water leaks out and the flammable liquid does not overflow the tank. This will provide time to off-load the remaining flammable liquid.
11. Wrecking operations or transfer of product should not begin until the area is determined safe. A combustible gas indicator should be used to check the area continually during the entire operation.
12. To prevent the build-up of static electricity, bond and ground containers and equipment before product transfer.
13. Empty tanks or tanks containing residue should be regarded as containing an ignitable vapor air mixture.
14. Cutting torches or spark generating saws must not be used on the shell of empty or loaded cars or containers.
15. If it can be done safely, move undamaged containers to a safe area, being careful to avoid sparks or friction.

16. Do not separate tractor units from their trailer, as the support gear on the trailer may fail.

## **CLASS 4—FLAMMABLE SOLIDS**

### Operating Guidelines

#### **Definition**

Any solid material, other than an explosive, which under conditions normally incident to transportation is liable to cause fires through friction or retained heat from manufacturing or processing, or which can be ignited readily and, when ignited, burns so vigorously and persistently it creates a serious transportation hazard.

Included in this class are spontaneously combustible and water-reactive materials. Two materials shipped in bulk that can cause major problems for responders are phosphorus and sodium.

#### **General Information**

1. Identify the material(s) involved.
2. Keep non-essential people away. (This includes non-essential emergency service personnel.)
3. Establish control zones. (Isolate area and deny entry.)
4. Wear positive pressure SCBA and full protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for all incidents. In some cases chemical protective clothing carried by the HazMat Team will be required for the safe handling of the incident.
5. Stay upwind and keep out of low areas.
6. Avoid exposure to smoke, fumes, vapors, dust, or direct contact. Toxic products may be produced from contact with water, heat, and other substances.
7. Consider the need for additional resources and equipment. (diking material, absorbents, overpack containers, transfer equipment, private clean-up contractors, etc.)
8. If spilled material has entered storm or sewer systems, notify the proper authority.
9. Determine and implement appropriate decontamination procedures for personnel and equipment.
10. Consult CHEMTREC (800 424-9300) for product information and assistance.

#### **Fire Conditions**

1. **DO NOT USE WATER OR FOAM ON WATER REACTIVE MATERIALS.**

2. If it can be done safely, move containers from fire area.
3. Chemical reference sources will indicate appropriate extinguishing agents. Agents such as dry chemical, soda ash, lime, or sand may be appropriate for use on water-reactive materials, but they must be moisture free.
4. Water may be used to cool containers exposed to fire, but if the water contacts water-reactive materials, the incident could escalate rapidly.

### **Spill or Leak**

1. Keep ignition sources away.
2. Extinguish all sources of ignition in the vicinity. Do not allow vehicles or other sources of ignition in the area.
3. If it can be done safely, attempt to close valves, plug, reposition containers, or otherwise reduce the amount of leakage.
4. Keep water-reactive materials dry. **DO NOT** get water inside containers containing water-reactive materials.
5. Keep material out of storm, sewer, and water systems.
6. Dig trenches or build dikes around spills of water reactive or environmentally damaging materials to prevent water from reaching them.
7. Powder spills can be covered with a plastic sheet or tarp to minimize spreading and prevent water/moisture contact. Warning: If the sun is shining directly on the plastic sheeting, moisture may collect on the under-side of the sheeting, producing a reaction with water-reactive materials.

## **CLASS 5—OXIDIZERS & ORGANIC PEROXIDES**

### Operating Guidelines

#### **Definition**

An oxidizer is a substance that yields oxygen readily to stimulate the combustion of organic matter. (Chlorate, permanganate, inorganic peroxide, or nitrate.)

An organic peroxide is a derivative of hydrogen peroxide in which part of the hydrogen has been replaced by an organic material. (Benzoyl peroxide.)

#### **General Information**

1. Identify the material(s) involved. The percent of concentration of the material should be determined, as many materials in this category have been specially formulated to reduce the threat of reaction.
2. Keep non-essential people away. (This includes non-essential emergency service personnel.)
3. Establish control zones. (Isolate area and deny entry.)

4. Stay upwind and keep out of low areas.
5. Ventilate confined areas before entering.
6. Wear positive pressure SCBA and full protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for all incidents. In some cases chemical protective clothing carried by the HazMat Team will be required for the safe handling of the incident.
7. Avoid exposure to smoke, fumes, vapors, dust, or direct contact. Toxic products are frequently produced by burning oxidizers.
8. Caution should be exercised when water is used on oxidizers, as most oxidizers are water-soluble and will produce solutions that can impregnate wood and other organic combustibles. Upon drying, these materials can spontaneously ignite and burn vigorously.
9. In accidents involving chlorates and other oxidizing materials, care is necessary to prevent ignition by friction or contact with acids.
10. When chlorates are mixed with organic matter, or even dust, a very flammable mixture is formed.
11. Chlorates mixed with finely divided combustible material may burn with explosive violence.
12. Leaking of nitric acid, perchloric acid, or hydrogen peroxide may cause fire. These materials are also corrosive.
13. Organic peroxides generally have the special property that if they are heated beyond their transportation temperatures, they are likely to detonate.
14. Consider the need for additional resources and equipment. (diking material, absorbents, overpack containers, transfer equipment, private clean-up contractors, etc.)
15. If spilled material has entered storm or sewer systems, notify the proper authority.
16. Determine and implement appropriate decontamination procedures for personnel and equipment.
17. Consult CHEMTREC (800 424-9300) for product information and assistance.

### **Fire Conditions**

1. If it can be done safely, remove any containers not already burning.
2. Cool affected containers with flooding quantities of water. For massive fires, use unmanned monitors. If this is not possible, withdraw and let the fire burn. Run-off water must be contained for later analysis and possible disposal.



**Spill or Leak**

1. Keep flammables, combustibles and organic materials away from spilled material.
2. Avoid contact with the spilled material.
3. Extinguish all sources of ignition in the vicinity. Do not allow vehicles or other sources of ignition in the area.
4. If it can be done safely, close valves, plug, or attempt to reduce the amount of leakage.
5. Water spray can be used to absorb water miscible vapors, and water spray or explosion proof fans can be used to disperse vapors. Do not get water inside containers. Run-off must be contained for later analysis and possible disposal. Do not permit the run-off to enter storm, sewer, or water systems.
6. Keep material out of storm, sewer, and water systems.
7. Dig trenches or build dikes ahead of the flow to contain the spill for later disposal.
8. Cover powder spills with a plastic sheet or tarp to minimize spreading.

**CLASS 6—POISONS ( INCLUDING PESTICIDES, AND INFECTIOUS SUBSTANCES)**

## Operating Guidelines

**Definition**

Class A poisons are poisonous gases or liquids which are extremely dangerous, and a very small amount of the gas or vapor of the liquid mixed with air is dangerous to life. (Hydrogen cyanide and phosgene.)

Class B poisons are liquids or solids (including pastes and semi-solids) which are known to be so toxic to man as to create a health hazard during transportation, or which are presumed toxic to man based on laboratory tests with animals. (Parathion and toluene diisocyanate.)

A pesticide is any substance, organic or inorganic, used to destroy or inhibit the action of plant or animal pests; the term includes insecticides, herbicides, rodenticides, mitidices, etc. Virtually all pesticides are toxic to humans to some degree.

**General Information**

1. Identify the material(s) involved.
2. Keep non-essential people away. (This includes non-essential emergency service personnel.)
3. Establish control zones. (Isolate area and deny entry.)

4. Wear positive pressure SCBA and full protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for all incidents. Due to the construction and materials used for firefighter turnout clothing, the clothing may actually absorb and hold the pesticide or poison if contact with the smoke, fumes, vapors, dust, or material occur. The firefighter would be re-exposed each time the clothing was worn if proper decontamination operations were not performed.

In most incidents involving pesticides and poisons, the chemical protective clothing carried by the HazMat Team will be required for the safe handling of the incident.

5. Stay upwind and keep out of low areas. If you can smell the pesticide, you are too close and not sufficiently protected.
6. Avoid exposure to smoke, fumes, vapors, dust, or direct contact.
7. Determine signs and symptoms of exposure and advise all personnel operating at the site. Some symptoms may not become present for up to 48 hours following exposure.
8. Ventilate confined areas before entering. It is not advisable for Fire Department personnel to enter tanks or other confined spaces that contain or have contained pesticides and/or poisons.
9. If spilled material has entered storm, sewer, or water systems, notify the proper authority. Maps should be used to determine the direction of flow and destination (outflow) of the system. Consideration should be given to diking ahead of the flow.
10. Determine and implement appropriate decontamination procedures.
11. Flush any contacted material from skin immediately.
12. Remove and isolate any contaminated clothing at the site and avoid spreading contamination to non-contaminated areas.
13. Consult CHEMTREC (800 424-9300) for product information and assistance.

### **Fire Conditions**

1. Consider protecting exposures and allowing the fire to burn. This may create less of a hazard to people and the environment, especially if run-off cannot be confined.
2. For small fires, use dry chemical, CO<sub>2</sub>, water spray or the appropriate foam.
3. For large fires use the appropriate foam or water spray.
4. Do not extinguish fire unless the flow can be stopped.
5. If sufficient water is available, use water spray to cool containers exposed to the fire.
6. Dike fire control water for later analysis and/or disposal.

**Spill or Leak**

1. For liquid pesticide spills, extinguish or eliminate all sources of ignition in the vicinity as many pesticides have flammable liquids as the carrier for the poison. Use combustible gas indicators to determine the boundary of the flammable vapors if the pesticide is a flammable. The absence of a reading on a CGI does NOT indicate the absence of a toxic atmosphere.
2. Do not allow vehicles or other sources of ignition in the area as long as the combustible gas indicator indicates the presence of flammable vapors.
3. If it can be done safely, close valves, plug, or attempt to reduce the amount of leakage.
4. Water spray can be used to absorb water miscible vapors, and water spray or explosion proof fans can be used to disperse vapors. Do not get water inside containers. Run-off must be contained for later analysis and possible disposal. Do not permit the run-off to enter storm, sewer, or water systems.
5. Keep material out of storm, sewer, and water systems.
6. Dig trenches or build dikes ahead of the flow to confine the spill for later disposal or recovery.
7. Cover powder spills with a plastic sheet or tarp to minimize spreading.

**INFECTIOUS SUBSTANCES**

## Operating Guidelines

**Definition**

An etiologic agent is a microorganism or its toxin that causes or may cause human disease. (Rabies virus.)

**General Information**

1. Identify the material(s) involved. Infectious substances include the red "Infectious Waste" bags and "Sharps" containers from hospitals. Sharps containers are used for the disposal of needles and other sharp instruments. Caution should be used if these containers are encountered.
2. Keep non-essential people away. (This includes non-essential emergency service personnel.)
3. Establish control zones. (Isolate area and deny entry.)
4. Wear positive pressure SCBA if there is indication that the infectious substance has become airborne and chemical protective clothing, especially impermeable gloves. Firefighter protective clothing will not provide adequate protection for all incidents involving infectious substances. The chemical protective clothing carried by the HazMat Team will be required for the safe handling of the incident.

5. Stay upwind and keep out of low areas.
6. Avoid exposure to smoke, fumes, vapors, or dust. Do not contact damaged containers or spilled material. Virus and disease bearing substances are often present.
7. If leakage is discovered in transit, the vehicle must not be moved and the area must be isolated.
8. If spilled material has entered storm or sewer systems, notify the proper authority.
9. Implement appropriate decontamination procedures. A freshly mixed 10% or stronger bleach/water solution is an effective decontamination solution for most infectious substance exposures.
10. Immediately notify the Communications Center so they can contact the Department of Public Health (DPH) Environmental Health Section. During normal working hours, The DPH has a vehicle available to haul small quantities of hazardous materials. They can be contacted by calling 252-3800, and asking for the hazardous waste program. After hours, page the DPH Emergency Responder at 252-3855. Proper notification will be made by the DPH.

### **Fire Conditions**

1. If it can be done safely, move containers from fire area. Do not touch or move damaged containers.
2. Use dry chemical, soda ash, or lime for small fires.

### **Spill or Leak**

1. Cover damaged containers or spill area with dampened towel or rag, and keep wet with liquid bleach. To decontaminate the area and equipment, a garden sprayer with a 10% bleach/water solution can be used to spray exposed surfaces. Recently mixed bleach/water solutions should be used, as pre-mixed solutions will lose their strength rapidly.
2. Dike spills for later disposal.
3. Keep material out of storm, sewer, and water systems.

## **CLASS 7—RADIOACTIVE MATERIALS**

### Operating Guidelines

#### **Definition**

A radioactive material is a substance having a specific activity greater than 0.002 micro curies per gram. (Medicines.)

## **General Information**

1. Identify the material(s) involved. Radioactive materials are often shipped in lead containers.
2. Keep all persons as far away as is practical, at least 150 feet upwind.
3. Establish control zones. (Isolate area and deny entry.) Use radiation monitoring devices to determine control zones and assess areas of contamination.
4. Wear at least full-face air purifying respirators with HEPA filters, and full protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for radioactive incidents.
5. Avoid exposure to smoke, fumes, vapors, dust, or direct contact.
6. All personnel should utilize dosimeters. Zero dosimeters prior to use.
7. Entry should not be made until appropriate radiological personnel are on scene and the degree of radiation is known.
8. Enter Hot Zone only to save life, and limit entry into the Hot Zone to shortest possible time.
9. If spilled material has entered storm or sewer systems, notify the proper authority.
10. Implement appropriate decontamination procedures for personnel and equipment.
11. Delay cleanup until arrival of, or instructions from, qualified radiation personnel.
12. Equipment used in the Hot Zone shall not be removed until appropriate decontamination procedures have been performed and the equipment has been monitored and declared clean.
13. Contact local radiological team for assistance and equipment.  
San Francisco Area Phone 1-800-852-7550 or (510) 540-2014
14. Consult CHEMTREC 1-800- 424-9300 for product information and assistance.

## **Fire Conditions**

1. Do not move damaged containers, but undamaged containers should be moved to a safe area if it can be done safely.
2. Assume the fire involves the radioactive materials.
3. Avoid exposure to smoke, fumes, or dust. Airborne contamination is a great cause of concern for emergency responders. Stay upwind of fire area.
4. Evacuate downwind area.
5. The fire should be extinguished as quickly as possible, with a minimum amount of water. Try not to disturb the radioactive containers.
6. Fight fire from maximum distance. Do not allow personnel into area after fire knockdown.

7. For massive fires, use unmanned monitors.
8. Dig trenches or build dikes ahead of the flow to contain the spill for later disposal.
9. The fire area should not be overhauled.

### **Spill or Leak**

1. Do not touch damaged containers or contact the spilled material.
2. Prevent spread of spilled material and keep it out of water systems and sewers. Dike far ahead of large spills to confine for later disposal.

## **CLASS 8—CORROSIVES**

### Operating Guidelines

#### **Definition**

A corrosive material is a liquid or solid that causes visible destruction or irreversible alterations in human skin tissue at the site of contact, or, in the case of leakage from its packaging, a liquid that causes a severe corrosion rate to steel. (Acids [sulfuric, hydrochloric, nitric] and bases [sodium hydroxide, ammonia, amines].)

#### **General Information**

1. Identify the material(s) involved.
2. Keep non-essential people away. (This includes non-essential emergency service personnel.)
3. Establish control zones. (Isolate area and deny entry.)
4. Wear positive pressure SCBA and chemical protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for corrosive incidents. The chemical protective clothing carried by the HazMat Team will be required for the safe handling of most incidents involving corrosives.
5. Stay upwind and keep out of low areas.
6. Avoid exposure to smoke, fumes, vapors, dusts, or direct contact. Highly toxic fumes are often present.
7. Ventilate confined areas before entering.
8. Consider the need for additional resources and equipment. (diking material, absorbents, overpack containers, transfer equipment, private clean-up contractors, etc.)
9. If spilled material has entered storm or sewer systems, notify the proper authority.
10. Determine and implement appropriate decontamination procedures for personnel and equipment.

11. Consult CHEMTREC (800 424-9300) for product information and assistance.

### **Fire Conditions**

1. Many corrosive chemicals react violently with water, liberating heat and toxic gases.
2. If it can be done safely, move undamaged containers from the fire area.
3. Do not get water inside container.
4. Use water to cool containers that are exposed to flames until well after the fire is out. Do not allow water to get inside containers.

### **Spill or Leak**

1. Avoid contact with the spilled material.
2. Extinguish all sources of ignition in the vicinity. Do not allow vehicles or other sources of ignition in the area.
3. Do not apply water unless directed to do so. Contact with water may cause the generation of large quantities of vapors and heat.
4. Do not get water inside container.
5. Water spray can be used to absorb water miscible vapors, and water spray or explosion proof fans can be used to disperse vapors. Do not get water inside containers and do not put water on leak or spill area. Run-off must be contained for later analysis and possible disposal. Do not permit the run-off to enter storm, sewer, or water systems.
6. Keep combustibles (wood, paper, oil, etc.) away from spilled material.
7. If it can be done safely, close valves, plug, or attempt to reduce the amount of leakage.
8. Dig trenches or build dikes ahead of the flow to contain the spill for later disposal or recovery.
9. Powder spills can be covered with a plastic sheet or tarp to minimize spreading.
10. Keep material out of storm, sewer, and water systems.
11. Do not attempt neutralization. Neutralization may cause the production of vapors and heat, creating additional problems.





## APPENDIX B—GLOSSARY

**ABSORPTION.** To take into the body through the skin.

**ACGIH (AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS).** A private organization made up of occupational safety and health professionals. ACGIH recommends occupational exposure limits for many toxic substances. These limits are called Threshold Limit Values (TLVs). ACGIH updates its recommended limits annually. These limits are not legally enforceable.

**ACID / ACIDIC.** A substance with a pH of less than 7 ( $\text{pH} < 7$ ) that reacts with bases to form salts. Strong acids (low pH) can burn the skin and other parts of the body. Weaker acids may irritate the skin and eyes. Examples include lemon juice (citric acid) and vinegar (acetic acid), which are weak acids and car battery acid (sulfuric acid), which is a strong acid.

**ALIPHATIC HYDROCARBON.** A solvent or oil in which only hydrogen and carbon are involved and there are no double bonds. Typical aliphatic hydrocarbons are kerosene, most paint thinners, and Stoddard solvent.

**AMINE.** A hydrocarbon with a functional group (reactive area of the molecule) of  $\text{NH}_2$  which can act very much like ammonia in lung irritation activity causing a delayed pulmonary edema. Amines can be very basic, however some are very mild and present no hazard.

**AQUEOUS SOLUTION.** A water solution. Typical aqueous solutions would be salt water, soda pop, etc.

**AROMATIC HYDROCARBON.** A solvent in which the main component contains a benzene ring. These tend to be slightly more toxic than aliphatic hydrocarbons, but have the same general chemical toxicology of causing central nervous system depression. Benzene, the most basic of the aromatic hydrocarbons, is considerably more toxic and is very destructive to the blood producing organs, especially if there is a long period of exposure.

**ASPHYXIANT.** A material that is not very toxic in itself, but has the property to remove oxygen from the atmosphere. Less than 12 percent oxygen in the air is sufficient to create a situation where death by asphyxiation may occur. Examples of simple asphyxiants include argon, freon, carbon dioxide, and nitrogen.

**BASE / BASIC.** A substance with a pH greater than 7 that reacts with acids to form salts. Strong bases (high pH) can cause severe burns of the skin, eyes, or other parts of the body. Basic substances may feel slippery on the skin. An example of a weaker base is baking soda (sodium bicarbonate); examples of stronger bases are lye (sodium hydroxide) and lime (calcium oxide).

**BOILING POINT.** The temperature at which a liquid boils. At the boiling point a liquid changes to a vapor (evaporates) at the fastest rate possible. The boiling point of water is  $212^{\circ}\text{F}$  ( $100^{\circ}\text{C}$ ). At this

temperature water vapor is seen as steam.

**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. (CFR 29 1910.120)

**CANCER.** The uncontrollable growth and spread of abnormal cells in the body. Substances that cause cancer are called carcinogens. In most cases exposure to carcinogens must occur over a number of years or at very high doses before they cause cancer.

**CARCINOGEN.** A substance capable of causing cancer. "Known human carcinogens," such as asbestos or cigarette smoke, are substances that have been scientifically proven to cause cancer in humans. "Suspect carcinogens" are substances that have caused cancer in lab animals and, therefore, are suspected of being a possible cause of cancer in humans.

**CAS NUMBER (CHEMICAL ABSTRACT SERVICE REGISTRY NUMBER).** A number assigned to a specific chemical compound. Every chemical is given a CAS number so that it can be identified. This is like each individual having a unique social security number.

**CAUSTIC.** Describes a strong base that can severely irritate, corrode, or destroy living tissue, such as skin or lungs. Caustics may also eat away at wood or metal. Contact with a caustic material may not cause pain

immediately, but may continue to damage the skin or other body tissues. Examples of caustic substances are drain cleaners, lye (sodium hydroxide), lime (calcium oxide), and caustic potash (potassium hydroxide). Caustics often have secondary characteristics. Cyanide, arsenic, and strychnine (all poisons) often have pHs near or above 12.

**CEILING LEVEL.** An airborne level of human inhalation exposure to a material which should NEVER be exceeded.

**CHEMICAL ASPHYXIANTS.** Materials that prevent or slow down the absorption of oxygen by the blood, causing illness or death due to the lack of oxygen to the body despite sufficient available oxygen in the atmosphere.

**CHLORINATED HYDROCARBON.** A hydrocarbon which contains one or more chlorine atoms. Most of the chlorinated hydrocarbons that are likely to be seen at a spill are cleaning solvents. Chlorinated hydrocarbons have a very high odor threshold, and it is not uncommon to have people asphyxiated by these solvents in confined areas while doing cleaning operations. The vapors are heavier than air and can easily collect in low areas. When involved in fire, chlorinated hydrocarbons produce hydrochloric acid. When there is a high intensity energy source, they can produce highly toxic phosgene gas. Heart attacks and permanent liver or kidney damage have been associated with short term, high level exposure to chlorinated hydrocarbons.

**CHRONIC EFFECTS.** Health effects that persist for a long period of time and may never go away are referred to as chronic. For example, cigarette

smoking causes lung damage that may result in a chronic cough, shortness of breath, and/or lung cancer.

**COLD ZONE.** This area contains the Command Post and such other support functions as are deemed necessary to control the incident.

**COMBUSTIBLE LIQUID.** A liquid with a flash point between 100°F and 200°F that can catch on fire and burn. If a combustible liquid is stored at a temperature near its flash point, it may catch on fire and burn if a spark or flame is available. The vapors of combustible liquids will not catch on fire as easily as those of flammable liquids. For example, diesel fuel is a combustible liquid, with a flash point of approximately 110°F. Combustible does not mean explosive.

**CONCENTRATION.** The amount of one substance present in a given volume of another substance. For example, a mixed drink made with two jiggers of Scotch (ethanol) has a higher concentration of Scotch than a drink made with only one jigger of Scotch.

**CONFINED SPACE.** Refers to a space which by design has limited openings for entry and exit; unfavorable natural ventilation which could contain or produce dangerous air contaminants, and which is not intended for continuous employee occupancy. Confined spaces include but are not limited to storage tanks, compartments of ships, process vessels, pits, silos, vats, degreasers, reaction vessels, boilers, ventilation and exhaust ducts, sewers, tunnels, underground utility vaults, and pipelines.

**CONFINEMENT.** Those procedures taken to keep a material in a defined or local area.

**CONTAINER.** Any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like that contains a hazardous material.

**CONTAINMENT.** Those procedures taken to keep a material in its container.

**CONTAMINANT/CONTAMINATION.** A substance or process that poses a threat to life, health, or the environment.

**CONTROL.** The procedures, techniques and methods used in the mitigation of a hazardous materials incident, including containment, extinguishment and confinement.

**CONTROL ZONES.** The designation of areas at a hazardous materials incident based upon safety and the degree of hazard. Many terms are used to describe the zones involved in a hazardous materials incident.

**CORROSIVE.** A solid or liquid substance that will "eat away" metal and can severely damage the skin or other body tissues. Corrosive substances can burn and irritate the skin, and cause permanent damage such as scarring. Skin and eyes should be protected from corrosive substances. A substance with a pH of 2 or less ( $\text{pH} \leq 2$ ) (strong acids) and a substance with a pH of 12.5 or more ( $\text{pH} \geq 12.5$ ) (strong caustic) are categorized as corrosives by the Environmental Protection Agency (EPA).

**DECONTAMINATION.** The removal of hazardous substances from employees and their equipment to the extent necessary to preclude the occurrence of foreseeable adverse health effects.

**DECONTAMINATION CORRIDOR.** An area located in the warm zone where decontamination takes place.

**EMERGENCY RESPONSE.** A response effort by employees from outside the immediate release area or by other designated responders to an occurrence which results, or is likely to result, in an uncontrolled release of a hazardous substance.

**ENTRY TEAM.** Two or more HazMat Group members assigned to perform the necessary functions within the Hot Zone. Line of sight contact among personnel operating in the Hot Zone must be maintained.

**EXPOSURE.** Exposure to a toxic substance occurs when that substance enters a person's body. Substances can enter the body when they are inhaled, swallowed, or absorbed through the skin. Harmful effects may occur if the person is exposed to enough of the substance.

**EXTREMELY FLAMMABLE.** The flash point is less than 30°F.

**FLAMMABLE.** A liquid with a flash point from 30°F. to 100°F.

**FLAMMABLE LIQUID.** A liquid with a flash point below 100°F. The lower the flash point, the more flammable the liquid. For example, regular gasoline is an extremely flammable liquid with a flash point of -44°F.

**FLASH POINT.** The lowest temperature at which a liquid gives off enough vapor to ignite (start to burn) if it comes in contact with a spark, flame, or other ignition source. If the liquid is above its flash point, vapors are getting into the air and respiratory protection

may be required as the flammable liquid may also have toxic properties.

**FUME.** Small solid particles that become airborne when a solid material is heated or burned. Fume is often misused to mean vapor. Fumes can be inhaled and may cause health problems. Metal fumes are produced during welding or smelting operations.

**HAZARDOUS MATERIAL.** A substance that may be dangerous or harmful. A hazardous material is one that is flammable, corrosive, reactive, toxic, infectious, or has other hazardous properties. Hazardous materials include hazardous substances (new products) and hazardous waste (used, no longer needed) products.

**HAZARDOUS MATERIALS RESPONSE TEAM (HAZMAT TEAM).** An organized group of employees designated by the employer, who are expected to perform work to handle and control actual or potential leaks or spills of hazardous substances requiring possible close approach to the substance.

**HAZARDOUS WASTE.** A material being disposed of or recycled that may, because of its quantity or hazardous properties, be a threat to human health or the environment.

**HEALTH HAZARD.** A chemical, mixture of chemicals, or a pathogen for which there is statistically significant evidence that acute or chronic health effects may occur in exposed employees.

**HOT LINE.** The boundary which separates the Hot Zone from the Warm Zone and the Decontamination Corridor.

**HOT ZONE.** Area immediately surrounding a hazardous materials incident that extends far enough to prevent adverse effects from hazardous materials releases to personnel outside the zone.

**HYDROCARBONS.** A substance containing only the elements hydrogen and carbon. Hydrocarbons are derived from oil or petroleum products. For example, gasoline, diesel fuel, safety solvent, and grease are hydrocarbons. Hydrocarbons are one type of organic compound.

**HYDROLYZING.** The process where a chemical substance reacts with water to become some other material. For example, dimethyl sulfate in water becomes methane and sulfuric acid, creating considerable heat. This is a form of a water-reactive material. These can be very dangerous chemicals.

**IARC (INTERNATIONAL AGENCY FOR RESEARCH ON CANCER).** IARC is a part of the World Health Organization (WHO). IARC is an organization that evaluates scientific research to determine which chemicals are known or suspected of causing cancer in humans. If IARC lists a chemical as a carcinogen, it should be stated on the MSDS.

**IDLH (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. (29CFR 1910.120)

**INCIDENT COMMAND SYSTEM.** An organized system of roles, responsibilities, and standard operating procedures used to manage and direct emergency operations.

**INCIDENT COMMANDER.** The person responsible for all decisions relating to the management of the incident. The Incident Commander is in charge at the incident.

**INCOMPATIBLES.** Materials that can cause dangerous reactions if they come into contact with each other. When a substance reacts with another substance, the reaction may cause a fire or explosion, or create a new and more hazardous substance. For example, bleach and ammonia are incompatible because they can react with each other and release poisonous chlorine gas.

**INGESTION.** To take into the body by swallowing.

**INHALATION.** To take into the body by breathing.

**INORGANIC.** Describes compounds that do not contain the element carbon. These are materials that are not derived from oil or petroleum. Examples of inorganic compounds are salts, metals (including lead, tin, and mercury), and inorganic acids (such as hydrochloric acid).

**IRRITANT.** A substance, which upon contact with the skin, eyes, or other body tissues, causes a reaction such as itching, redness, or pain. For example, breathing ammonia may irritate the windpipe and lungs. Turpentine may irritate the skin and soap may irritate eyes.

**LEL (Lower Explosive Limit).** The minimum concentration of gas or vapor in air below which it is not possible to ignite the vapors.

**LC<sub>50</sub> (Lethal Concentration).** Stands for "Lethal Concentration -50%" or the concentration of a substance in air or water that will kill 50% of the test animals exposed to that concentration within a specific period of time. It is similar to the LD<sub>50</sub>, except that the animals are exposed to the substance in the air (or water for fish), rather than by injection or eating.

**LD<sub>50</sub> (Lethal Dose).** Stands for "Lethal Dose - 50%" or the amount of a substance that will kill 50% of the test animals in an experiment when the substance is fed to the animals (oral), injected (parenteral), or put on skin (dermal) over a specific period of time. A given chemical will generally show different LD<sub>50</sub> values depending on how it was given to the animal and the kind of test animal used. The lower the LD<sub>50</sub>, the more toxic or poisonous the material is, because it didn't take very much of the substance to kill 50% of the animals. The LD<sub>50</sub> for table salt (sodium chloride) is 4,000 mg/kg. Nicotine is much more toxic with an LD<sub>50</sub> of 1 mg/kg.

**MATERIAL SAFETY DATA SHEET (MSDS).** An information sheet provided by manufacturers and compounders (blenders) of chemicals, with minimum information about chemical composition, physical and chemical properties, health and safety hazards, emergency response and waste disposal of the material as required by OSHA 1910.1200.

**MONITORING EQUIPMENT.** Instruments and devices used to identify and quantify contaminants.

**MUTAGEN.** A substance capable of altering the genetic material in a living cell. Some mutagens cause a specific health effect (such as cancer), while other mutagens may cause genetic changes without any known health effect. If these mutations occur in egg or sperm cells, they may be passed on to the person's children.

**NITRILE.** This is a hydrocarbon with cyanide (CN) as its active group. These are not the same toxicologically as inorganic cyanide, but are toxic in their own right. When nitriles burn, cyanide gas is given off in large amounts.

**ODOR THRESHOLD.** The lowest airborne concentration of a material which is detectable by odor by an average person. After being exposed for a period of time, people can lose the ability to smell certain chemicals. Odor thresholds vary among individuals.

**ORGANIC.** Describes compounds that contain carbon. Organic compounds are usually derived from petroleum products or from living organisms. For example, vinegar (acetic acid) is an organic acid and gasoline is an organic solvent.

**ORGANIC PEROXIDES.** Organic peroxides are organic oxidizers. The inclusion of both the oxidizing capabilities and the fuel in a single molecule makes these potentially very explosive. This class of organic chemicals should be stored away from all other materials.

**OXIDIZER.** A chemical which initiates or promotes combustion in other materials. Oxidizers increase the flammability of materials and can cause fire either of itself or through the release

of oxygen or other gases. Chlorine is the second most common oxidizing gas.

**OXYGENATED HYDROCARBON.**

Commonly used hydrocarbons. The most familiar are alcohol, radiator fluids, and acetone. There is an oxygen atom attached to the hydrocarbon that makes the solvent slightly to very soluble in water.

**PEL (PERMISSIBLE EXPOSURE LIMIT).**

The concentration of a substance to which a worker can legally be exposed. PELs are usually expressed as mg/m<sup>3</sup> or ppm. The PEL can be an average daily exposure over time, or a "ceiling limit" (a maximum concentration that cannot be exceeded). These limits are established by OSHA (29 CFR 1910.1002). These limits are designed to protect the average worker from adverse health effects. Some workers may experience health effects when exposed to levels lower than the PEL. Others may experience no health effects when exposed to levels higher than the PEL.

**PENETRATION.** The movement of a material through a suit's closures such as zippers, buttonholes, seams, flaps, or other design features of chemical protective clothing and through punctures, cuts, and tears.

**PERIMETER SURVEY TEAM.** Two HazMat Group members that conduct a preliminary site evaluation around the perimeter of the incident to identify the hazards or suspected hazards of the site. They are equipped at the minimum with Level B PPE, direct reading monitoring equipment, binoculars, and a portable radio. Their function is to survey the incident site and report their findings. They are not to perform any control activities.

**PERMEATION.** A chemical action involving the movement of chemicals, on a molecular level, through intact material.

**PERSONAL PROTECTIVE**

**EQUIPMENT.** The equipment provided to shield or isolate a person from the chemical, physical, and thermal hazards that may be encountered at a hazardous materials incident. Adequate personal protective equipment should protect the respiratory system, skin, eyes, face, hands, feet, head, body, and hearing. Personal protective equipment includes both personal protective clothing and respiratory protection.

**pH.** The pH of a material can only be between 0 and 14. A pH of 7 is neutral and is considered the natural pH of water. As the number decreases below 7, the material is more acidic. As the number increases above 7, the material is more caustic. Normally, materials are not dangerous to humans until the pH reaches 2 on the acidic side or 12.5 on the caustic side. The pH of soap may be as high as 9 or 10, and cola can have a pH as low as 3. On the other hand, pHs of 3 or 10 can be very detrimental to the environment.

Acids work by forming bonds in the body's proteins. Caustics break proteins down into small pieces. Generally, acids have better warning properties, and pain can warn prior to irreparable damage. Caustics can do considerable damage prior to the person being aware of their actions. Very strong acids and caustics allow almost no time between contact and destruction of the tissue.

**POISON.** Any substance that is harmful to living organisms in relatively small

amounts. Poisons can cause illness or death.

**POLYMERIZATION.** A chemical reaction in which molecules of the same substance combine to form much larger molecules (polymers). This usually happens after exposure to heat, light, or another chemical. Polymerization may also release a lot of energy. In other words, it may cause an explosion or generate a lot of heat.

**PPM (Parts Per Million).** Parts by volume of the gas or vapor in a million parts of air. Also used to indicate the concentration of a particular substance in a liquid or solid.

**PROTECTIVE CLOTHING.** Equipment designed to protect the wearer from heat and/or hazardous materials contacting the skin or eyes. Protective clothing is divided into three types. (a) structural fire fighting protective clothing; (b) chemical protective clothing; and (c) high temperature protective clothing.

**PYROPHORIC.** A chemical that will ignite spontaneously in air at a temperature of 130°F. or below.

**REACTION.** A chemical transformation or change. The interaction of two or more substances to form new substances.

**RESPIRATORY PROTECTION.** Devices that will protect the users respiratory system from overexposure by inhalation to airborne contaminants. Respiratory protection is used when a worker must work in an area where he/she might be exposed to concentrations in excess of the allowable exposure limit.

**ROUTE OF EXPOSURE.** How a substance enters the body. The most common routes of exposure include inhalation (breathing), ingestion (swallowing), and absorption through the skin.

**SAFE REFUGE AREA.** An area near the Decontamination Corridor where citizens, victims, and emergency response personnel are staged while waiting to be decontaminated before entering the Decontamination Corridor.

**SENSITIZER.** A substance that causes some people to have an allergic reaction, including skin rashes or asthma. Sensitization to a substance may occur after only one exposure or after repeated previous exposures with no reaction.

**SOLUBILITY IN WATER.** A term expressing the percentage of a material (by weight) that will dissolve in water at ambient temperature. Solubility information can be useful in determining spill cleanup methods and fire extinguishing agents.

**SOLVENT.** A liquid that can dissolve another substance. Water is the most common solvent. Other solvents include degreasers, gasoline, alcohol, and paint thinners.

**SPECIFIC GRAVITY.** The weight of a solid or liquid compared to the weight of an equal volume of water. By definition, the specific gravity of water is 1.0. Materials lighter than water have a specific gravity less than 1.0. Materials heavier than water have a specific gravity greater than 1.0. Specific gravity is important when the material is not soluble in water. For example, gasoline has a specific gravity of 0.8. Water should not be used to extinguish a



gasoline fire because water will flow under the gasoline and cause it to spread.

**SPONTANEOUSLY COMBUSTIBLE.**

A material that ignites as a result of retained heat from processing; a material that will oxidize to generate heat and ignite; or a material that absorbs moisture to generate heat and ignite without an apparent source of ignition.

**SUBLIMES.** The literal meaning is the material goes from the solid to the gaseous state without becoming a liquid.

**TERATOGEN.** A chemical, physical, or biological agent that can cause birth defects by damaging the fetus. An example of a teratogen is methyl mercury. In Japan, pregnant women ate fish contaminated with methyl mercury. Their children were born with severe mental and physical problems. Ionizing radiation and German Measles (rubella) are also teratogens.

**TLV - C (Threshold Limit Value - Ceiling).** The ceiling limit, or the maximum concentration of a hazardous substance that should not be exceeded for even a brief moment during any part of the working exposure. This is the same as the OSHA Ceiling Limit. Ceiling limits are set when even brief exposures at this concentration can cause acute health problems.

**TLV - STEL (Threshold Limit Value - Short Term Exposure Limit).** The maximum average concentration of a hazardous substance to which a worker can be exposed for a continuous 15-minute period without suffering adverse health effects. This is similar to the OSHA Exclusion Limit, although the time period may vary.

**TLV - TWA (Threshold Limit Value - Time Weighted Average).** The concentration of a hazardous substance to which most workers can be exposed on the average for an eight-hour work day and a 40-hour work week without suffering health effects. (This is similar to an OSHA PEL.)

Some workers may experience symptoms below the TLV-TWA. Other workers may be exposed above the TLV-TWA without experiencing adverse health effects. A worker may be exposed above the below the TLV-TWA during any given day, but the average exposure should be below the TLV-TWA for that day. For example, if one worker is exposed to 80 ppm for 8 hours, and another worker is exposed to 40 ppm for 4 hours and 120 ppm for 4 hours, they both are exposed to an eight-hour TWA of 80 ppm.

**TOXIC SUBSTANCE.** A substance which can cause death or injury in small doses.

**TOXICITY.** The ability of a material to cause injury to the body or organs. The less material required to cause injury, the greater the toxicity.

**UEL (Upper Explosive Limit).** The maximum concentrations of gas or vapor in air above which it is no longer possible to ignite the vapors.

**VAPOR.** The gas given off by a material that is a solid or liquid substance at ordinary temperatures and pressures. For example, steam is the vapor given off by water.

**VAPOR DENSITY.** Weight of a vapor or gas usually compared to the weight of an equal volume of air. Materials lighter

than air have vapor densities less than 1.0. Materials heavier than air have vapor densities greater than 1.0. Lighter vapor density materials will tend to rise and dissipate (unless confined). Heavier vapors and gases are likely to concentrate in low places (along or under floors, in sumps, sewers, manholes, trenches, or ditches) where they may create fire or health hazards.

**VAPOR PRESSURE.** The tendency of a substance to evaporate. A substance with a higher vapor pressure will evaporate more easily than one with a lower vapor pressure, resulting in higher concentrations of the material in the air. For example, gasoline has a higher vapor pressure than diesel fuel, so gasoline will evaporate more rapidly.

**VISCOSITY.** Describes the thickness of a liquid, how fast or slow a liquid flows. Liquids such as water that flow easily have a low viscosity. Molasses or glue generally have a higher viscosity and flow more slowly.

**VOLATILITY.** A measure of how quickly a material evaporates. The more quickly a material evaporates, the more likely it can harm, as it is getting into the air.

**WARM LINE.** The boundary which separates the Warm Zone from the Cold (safe) Zone.

**WARM ZONE.** The area where personnel and equipment decontamination and Hot Zone support takes place. It includes control points for the access corridor and thus assists in reducing the spread of contamination.

**WATER-REACTIVE.** A material that reacts with water to release heat or form a hazardous substance including flammable or toxic gases or corrosive liquids.

## APPENDIX C—CHEMICALS TO MAKE EXPLOSIVES

The following list is not complete for all the chemicals that might be used to make explosives, but are the chemicals commonly used by anarchist's in the illegal making of explosives. The source for this list was The Anarchist Cookbook by William Powell. The names in parentheses following the chemical name is a synonym or common household substitute that may be used in some cases as a substitute for the pure chemical.

Aluminum powder	Magnesium sulfate (Epsom salts)
Antimony powder	Mercury
Antimony sulfate	Mononitronaphthalene
Ammonium chloride	Naphthalene (moth balls)
Ammonium hydroxide (ammonia)	Nitrated resin
Ammonium nitrate	Nitric acid (HNO <sub>3</sub> )
Ammonium nitrocreasol sulphonate	Nitrocellulose (nitrated sawdust)
Ammonium oxalate	Nitroglycerin
Ammonium perchlorate	Paraffin wax
Ammonium sulfate	Phenol
Aniline hydrochloride	Potassium bichromate
Barium nitrate	Potassium chlorate
Barium sulfate	Potassium chloride
Calcium carbonate	Potassium nitrate
Calcium silicide	Potassium perchlorate
Cellulose residue	Potassium perchloride
Charcoal flour	Potato starch
Charcoal powder	Powdered charcoal
Chlorine gas	Powdered sugar cane
Copper oxalate aniline	Pyro powdered aluminum
Copper sulfate	Resin
Dextrin	Rice starch
Dimethylaniline	Rye flour
Dinitrobenzene	Sawdust
Dinitronaphthalene	Sodium bicarbonate (baking soda)
Dinitrotoluene	Sodium carbonate (washing soda)
Ethylene glycol dinitrate	Sodium chloride (salt)
Graphite (pencil lead)	Sodium creasol sulphonate
Glycerin	Sodium sulphonate
Guanidine nitrate	Sodium nitrate
Guncotton	Sodium peroxide
Iodine crystals	Sodium sulfate, anhydrous
Lamp black	Sodium thiosulphate (photographer's hypo)
Magnesium carbonate	

APPENDIX C—CHEMICALS TO MAKE EXPLOSIVES

Starch  
Sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) (battery acid)  
Sulfur flour  
Tetryl

Toluene  
Vaseline  
Wheat flour  
Woodmeal

## APPENDIX D—CLANDESTINE DRUG LAB CHEMICALS

The following is not a complete listing of all chemicals that might be found in clandestine drug labs, but the list contains most of the common chemicals known to be used as of this date.

When chemicals are encountered in an unlikely setting during emergency operations, the area should be evacuated and isolated. If your presence at the location of a suspected clandestine drug lab resulted from a medical response, the patient should be treated as if he/she were contaminated, unless the preponderance of evidence suggests otherwise.

Acetic acid			TOXIC	CORROSIVE
Acetic anhydride			TOXIC	CORROSIVE
Acetone	FLAMMABLE	EXPLOSIVE		
Acetonitrile	FLAMMABLE		TOXIC	
Allylbenzene	FLAMMABLE		TOXIC	
Allylchloride	FLAMMABLE		TOXIC	
Ammonia				
Ammonium acetate				
Ammonium chloride			TOXIC	
Ammonium formate				
Aniline Anthranilic acid			TOXIC	CORROSIVE
Barbituric acid			TOXIC	CORROSIVE
Barium sulfate		EXPLOSIVE	TOXIC	
Benzaldehyde				
Benzenesulfonyl chloride			TOXIC	
Benzylamine Benzyl chloride			TOXIC	CORROSIVE
Benzylcyanide	FLAMMABLE	EXPLOSIVE	TOXIC	
Bromobenzene		EXPLOSIVE	TOXIC	CORROSIVE
Bromothiophene Butylamine				
Calcium chloride				
Calcium hydroxide	FLAMMABLE		TOXIC	
Chloroacetone				
Chloroform			TOXIC	
Copper sulfate				
Cyanide			TOXIC	
Cyclohexanone	FLAMMABLE	EXPLOSIVE		
Dimethyl malonate	FLAMMABLE	EXPLOSIVE	TOXIC	CORROSIVE
Ergotamine tartrate			TOXIC	
Ethanol	FLAMMABLE	EXPLOSIVE	TOXIC	
Ethers	FLAMMABLE	EXPLOSIVE	TOXIC	
Ethyl acetate	FLAMMABLE	EXPLOSIVE		
Ethyl amine	FLAMMABLE	EXPLOSIVE	TOXIC	
Ethyl malonite	FLAMMABLE	EXPLOSIVE	TOXIC	CORROSIVE
Formaldehyde	FLAMMABLE		TOXIC	
Formamide Formic acid	FLAMMABLE	EXPLOSIVE	TOXIC	CORROSIVE

APPENDIX D—CLANDESTINE DRUG LAB CHEMICALS

Hydrochloric acid			TOXIC	CORROSIVE
Hydriodic acid				
Hydrogen gas	FLAMMABLE	EXPLOSIVE		
Isopropyl alcohol	FLAMMABLE	EXPLOSIVE	TOXIC	
Lead acetate			TOXIC	
Lithium aluminum hydride	FLAMMABLE	EXPLOSIVE	TOXIC	
L-Lysergic acid			TOXIC	CORROSIVE
Magnesium sulfate				
Magnesium shavings	FLAMMABLE	EXPLOSIVE		
Manganous chloride				
Malonic acid			TOXIC	CORROSIVE
Mercuric chloride			TOXIC	
Methyl acrylate				
Methylamine	FLAMMABLE	EXPLOSIVE	TOXIC	
Methylene chloride			TOXIC	
Methyl piperidine				
Methylstyrene	FLAMMABLE			
Morpholine	FLAMMABLE	EXPLOSIVE	TOXIC	
N-Acetylanthranilic acid			TOXIC	CORROSIVE
N-Methylformamide Nitric acid			TOXIC	CORROSIVE
Nitrile acid	FLAMMABLE	EXPLOSIVE	TOXIC	CORROSIVE
Nitroethane				
O-Toluidine				
Perchloric acid				
Phenethylamine				
Phenylacetone nitrile				
Phenylacetic acid				
2-Phenyl 1-bromoethane				
1-Phenyl 2-bromopropane				
Phenylpropanolamine HCl				
Phenyl 2-propanone				
Phosphoric acid				
Phosphorous pentachloride			TOXIC	CORROSIVE
Phosphorus oxychloride				
Phosphorus trichloride				
PC 13				
Piperidine	FLAMMABLE	EXPLOSIVE	TOXIC	CORROSIVE
Polyphosphoric acid			TOXIC	CORROSIVE
Potassium cyanide			TOXIC	
Potassium hydroxide			TOXIC	CORROSIVE
Potassium iodide				
Propane	FLAMMABLE	EXPLOSIVE		
Propionic anhydride				
Pyrrolidine	FLAMMABLE	EXPLOSIVE	TOXIC	
Pyridine	FLAMMABLE	EXPLOSIVE	TOXIC	
Red phosphorous	FLAMMABLE		TOXIC	
Reduced aluminum foil				
Sludge	FLAMMABLE	EXPLOSIVE	TOXIC	CORROSIVE
Sodium				
Sodium acetate	FLAMMABLE			
Sodium bisulfite				

## APPENDIX D—CLANDESTINE DRUG LAB CHEMICALS

<b>Sodium borohydride</b>				
<b>Sodium cyanide</b>				
<b>Sodium cyanohydrinborate</b>	EXPLOSIVE	EXPLOSIVE	TOXIC	
<b>Sodium hydroxide</b>			TOXIC	CORROSIVE
<b>Sodium metabisulfite</b>			TOXIC	
<b>Sodium sulfate</b>	FLAMMABLE	EXPLOSIVE	TOXIC	
<b>Sodium thiosulfate</b>				
<b>Sulfuric acid</b>			TOXIC	CORROSIVE
<b>Thallium nitrate</b>			TOXIC	
<b>Thionyl chloride</b>			TOXIC	CORROSIVE
<b>Toluene</b>	FLAMMABLE	EXPLOSIVE	TOXIC	
<b>Toluene sulfonic acid</b>			TOXIC	

## APPENDIX E—MATERIAL SAFETY DATA SHEETS

The regulations which implement the Hazardous Substances Information and Training Act do not specify the format to be used when writing a Material Safety Data Sheet (MSDS). Despite the model MSDS provided in the regulation, many manufacturers and formulators have developed their own formats. Because of the various formats, careful reading and an understanding of some scientific terms may be required to find and understand needed information in an MSDS.

### SECTION I—PRODUCT IDENTIFICATION

Section I provides the manufacturer's name, trade mark, product identification, a contact phone number, and often a contact person.

Some useful emergency phone numbers:

- **Institute Maker's of Explosives**           **1-212-689-3237**
- **Oil Spills**                                       **1-800-852-7550**
- **Center for Disease Control**           **1-404-633-5313**
- **CHEMTREC**                                   **1-800-424-9300**
- **DOT Trans shipment Information**   **1-202-462-9280**
- **Poison Control Center**               **1-800-876-4766**

### SECTION II—INGREDIENTS & HAZARDS

#### Ingredient

Section II lists the hazardous ingredients. Usually the most commonly used name will be listed along with several synonyms. Many industries have a trade name for a material, so the listed name may be unfamiliar. The material can be cross-referenced by the CAS number if the number has been provided.

Many MSDS will also list non hazardous materials, however law does not require this. An ingredient must be listed if it is more than 1% of the total end product and is a hazardous material or if it is more than 0.1% and one of several regulated carcinogens.

The percentage of ingredients is not legally required to appear on the MSDS. If the percentage of ingredients is not shown, it is hard to access the hazard of the total product. As an example of how important this non required portion can be per this regulation, Chloroseptic and a 100% solution of phenol could have the same MSDS.



**CAS Number**

The Chemical Abstract Service (CAS) number is a unique number given to a chemical and often appears on the MSDS and is required in some states. The CAS number is a way to cross-reference a chemical in the event that the name used under ingredient is unfamiliar. The CAS Registry can provide additional information about the chemical. Not all chemicals have a CAS number.

**Exposure Limits in Air (Toxicity Data)**

This subsection lists representative results of acute toxicological studies conducted with the material or its listed components, usually in rats, mice, or rabbits. TLV/PEL/or Local PEL may all be listed. The Permissible Exposure Limit (PEL) is a legal standard for exposure to airborne contaminants specified in OSHA law. This is an average exposure over 8 hours a day, forty hours a week, over a working lifetime without adverse health effects.

**Threshold Limit Value (TLV)**

The TLV is a suggested exposure limit to airborne contaminants provided by the American Conference of Governmental Industrial Hygienists (ACGIH). A difference between the PEL and the TLV usually reflects a difference in current thinking from the time that the PEL was established. It is the quicker response to new information that makes the TLV an important resource.

When there is an absence of a PEL for a particular material, some manufacturers will provide an LD<sub>50</sub> (Lethal Dose to 50% exposed by ingestion). Usually this data will specify an animal. This data provides some idea of the relative toxicity of a material.

The chart below gives the ratings of materials depending upon the LD<sub>50</sub>. LC<sub>50</sub> (Lethal Concentration in air to 50% exposed) may be of use for comparison with the PEL and the TLV, as these are airborne standards.

<b>LD<sub>50</sub> TOXICITY RATING BY VARIOUS ROUTES OF ADMINISTRATION</b>					
<b>Toxicity Rating</b>	<b>Commonly Used Terms</b>	<b>LD<sub>50</sub> Single Oral Dose Rats</b>	<b>Inhalation 4 HR Vapor Exposure Mortality 2/6-4/6 Rats</b>	<b>LD<sub>50</sub> Skin Rabbits</b>	<b>Probable Lethal Dose for Man</b>
<b>1</b>	Extremely Toxic	1 mg or less/Kg	<10 ppm	5 mg or less/Kg	A taste (1 grain)
<b>2</b>	Highly Toxic	1-50 mg/Kg	10-100 ppm	5-43 mg/Kg	Teaspoon (4cc)
<b>3</b>	Moderately Toxic	50-500 mg/Kg	100-1,000 ppm	44-340 mg/Kg	1 ounce (30gm)
<b>4</b>	Slightly Toxic	0.5-5 g/Kg	1,000-10,000 ppm	350 mg-2.8 g/Kg	1 pint (250 gm)
<b>5</b>	Practically Non-toxic	5-15 g/Kg	10,000-100,000 ppm	2.82 g-22.59 g/Kg	1 quart
<b>6</b>	Relatively Harmless	15 g and more	>100,000 ppm	22.6 g or more/Kg	>1 quart

The LD<sub>50</sub> and the PEL are designed to provide a relative level of toxicity. Toxicity rating of 1 on a material indicates that there is a chance of poisoning with even the slightest ingestion. A toxicity of 6 would require a consumption of more than a quart to cause a

lethal dose. A chemical with a PEL of 1000 ppm is obviously less likely to cause problems through inhalation than a chemical that has a PEL of 1 ppm.

The PEL is supposed to have a protection factor of from 10 to 100. Not all PELs are based on a large body of scientific information. Unless there is a complete understanding on how the specific PEL was derived, the PEL should not be used as an absolute indicator of relative hazard. The LD<sub>50</sub> is usually more scientific, but may be deceptive as these are based on animal studies and may not translate directly to human experience. Most industrial exposure is by inhalation.

How hazardous a material is depends on how likely it is to get to YOU! Consider the information on relative toxicity provided in Section II along with the information on vapor pressure in Section III. For example, a bar of beryllium (a very toxic metal) with a very low PEL and almost no vapor pressure is not as dangerous as an open cup of acetone that has a very high PEL and a very high vapor pressure.

## SECTION III—PHYSICAL DATA

In the MSDS there is no legal requirement to rank the information in Sections III and IV as to importance. Some of the information is far more important in helping the user understand the hazards that a material poses. The listing of the information in Section III is in the order of how important the authors feel the information is in terms of emergency response. Much of the information in Section III is related to information in Section IV.

### Vapor Pressure

Vapor pressure is unfortunately NOT standardized, and may be presented in any units and at any temperature. Since temperature and vapor pressure are NOT linear, knowing the vapor pressure at one temperature does not necessarily give an indication of the vapor pressure at another temperature. The lower the boiling point of a liquid, the higher the vapor pressure.

Any material that has a flash point below 100oF has sufficient vapor pressure to allow it to come to you. That is a vapor pressure of about 10 mm Hg at 100oF.

### Conversion Factors

$$\begin{aligned} EC &= 5/9 \times (EF - 32) \\ 760.000 \text{ mm Hg} &= 1 \text{ ATM} \\ 1.867 \text{ mm Hg} &= 1 \text{ Inch(H}_2\text{O)} \\ 0.350 \text{ mm Hg} &= 1 \text{ lb./sq. ft.} \end{aligned}$$

### **Vapor Density**

Vapor density indicates how likely the material is to lie around once it has been released to the atmosphere. All gases will eventually dissipate, however initially there will be a tendency for the gas to stay in one area. How strong the tendency to stay will depend upon the temperature of both the atmosphere and the gas, atmospheric turbulence, the volume of gas released, and the amount of confinement.

A vapor density of 1 indicates that the gas is very similar physically to air. Materials that are liquids at room temperature will have a vapor density greater than 1, heavier than air. Concentrated vapors that are heavier than air can accumulate in low places such as along floors, in sewers, elevator shafts, etc.

A few commonly encountered gases have vapor densities of less than 1. These are helium, ammonia, hydrogen, acetylene, methane, natural gas, carbon monoxide, ethene, and nitrogen. If super cooled, all gases including hydrogen the lightest gas will lay on the ground as the cooling causes them to be denser.

### **Evaporation Rate**

Evaporation rate is the rate at which a material is converted to the vapor state at any given temperature and pressure. Evaporation rate is indicated as faster or slower than ethyl ether, unless otherwise stated. All materials evaporate; it is the differing rates that are of concern in fire protection.

### **pH**

This is rarely given in the MSDS. The EPA classifies a pH of 2 or less ( $\text{pH} < 2$ ) as an acid, and a pH of 12.5 or more ( $\text{pH} > 12.5$ ) as a caustic. The DOT definition of a corrosive is a liquid or solid that causes visible destruction or irreversible alterations in human skin tissue at the site of contact, or in the case of leakage from its packaging, a liquid that causes a severe corrosion rate to that package or to steel.

### **Appearance and Odor**

Odors can be very subjective, and odor thresholds vary for most substances. The appearance of a material may give some indication if what you have is as it should be. If you know the identity of the material and the odor threshold, the detection of an odor may give you an indication of the air concentration of the material.

### **Boiling Point**

This is the temperature at which a liquid changes to a vapor. Generally the lower the boiling point of a flammable liquid, the greater the fire hazard. The boiling point is related to and gives the vapor pressure (atmosphere) at one temperature (called the boiling point) and pressure (usually atmospheric pressure at sea level). For mixtures or

process streams, the initial boiling point or the boiling range may be given. Flammable materials with low boiling points generally present a special fire hazard.

### **Solubility In Water**

The percentage of a material (by weight) that will dissolve in water at ambient temperature. Solubility information can be useful in determining spill procedures and fire extinguishing agents and methods. The following is an explanation of terms used to express the solubility of a product by weight in water at ambient temperatures (most solvents are tested at 68o F.).

Negligible	less than 0.1 %
Slight	0.1 – 1 %
Moderate	1 – 10 %
Appreciable	more than 10 %
Complete	all proportions

### **Specific Gravity**

The ratio of the weight of the material compared to an equal volume of water, i.e. how dense (heavy) the material is in comparison to water. Insoluble materials with specific gravity's of less than 1 (one) will float on or in water, while a specific gravity of more than 1 (one) will sink below or in water. Most flammable liquids, but not all, are lighter than water.

### **Melting Point**

The temperature at which a solid substance changes to a liquid state. For mixtures, a melting range may be given. The melting point is close to and is sometimes called the freezing point.

## **SECTION IV—FIRE AND EXPLOSION DATA**

This section describes factors that should be considered when encountering a fire or the potential for ignition of the material.

### **Flash Point And Method Used**

The flash point gives a good idea of how likely something is to be ignited should there be an available spark source in the area. The flash point is the lowest temperature, which will cause vapor to be given off in sufficient quantity to ignite in the presence of an ignition source.

Since flash points vary with the test method, the method is shown. Tag Closed Cup (TCC), Tag Open Cup (TOC), and Cleveland Open Cup (COC) are some of the more common methods.

Open cup flash points will be higher than closed cup flash points. Flash point is directly related to the vapor pressure, with a flash point of 100EF indicating a vapor pressure of between 10 and 20 mm Hg at 100EF.

The Flash point has a specific legal definition:

<u>FLASH POINT</u>	<u>DEFINITION</u>
Less than 30EF	Extremely Flammable
Less than 100EF	Flammable
Over 100EF	Combustible
Less than 140EF	Ignitable

#### Flammable or Explosive Limits

- LEL – Lower Explosive Limit
- LFL – Lower Flammable Limit
- UEL – Upper Explosive Limit
- UFL – Upper Flammable Limit  
(LEL = LFL and UEL = UFL.)

When flammable vapors are mixed with air in the proper proportions, the mixture can be ignited. The LEL and the UEL designate the range of concentrations over which the flash will occur. Explosive (flammable) Limits are expressed as percent. The following may be of use in understanding LEL and UELs.

Some things can change the estimate of the flammability:

1. A material which can burn at 100% concentration in air. Hydrazine and acetic acid each have a flash point close to 100EF and the vapor pressure is close to 10 mm Hg at 30EC. Acetic acid is very difficult to ignite, but hydrazine with a UEL of 100% ignites as though the flash point were much lower.
2. The size of the range. Greater than a 12% range should be considered as a sufficiently broad band that explosion is increasingly more likely. How broad the band is will also give some indication of where the material is most hazardous.

For example, when comparing the characteristics of hydrogen (71% range) with those of methane (10% range), hydrogen tends to burn at the site of a leak fairly quickly, but tends to explode in pipes and reactors. Methane tends to build up in leak situations and explode, but isn't so likely to explode in pipes and reactors.

3. The absolute percentage of the LEL. An LEL of 16% ammonia is less likely to ignite than an LEL of 3% benzene.

### **Extinguishing Media**

Flammable or combustible chemicals behave differently when burning, dependent on their physical characteristics and flammable characteristics. Therefore the extinguishing media must be selected for its ability to extinguish a fire or not to increase the problems associated with the fire. Water, dry chemical, foam (AFFF, protein), CO<sub>2</sub>, Halon 1211, and Halon 1301 are some commonly used extinguishing media.

### **Special Fire Fighting Procedures**

Ordinary fire fighting procedures are not described, but special procedures may be listed here.

**Unusual Fire and Explosion Hazards:** Hazardous chemical reactions and changes in chemical composition or by products during fire or high heat conditions will be shown. This is an area where considerable research still needs to be done. This is often an area of the MSDS where questionable statements are found or where inadequate information is likely.

**Auto Ignition Temperature:** The approximate lowest temperature at which a flammable or vapor air mixture will spontaneously ignite without a spark or flame. Auto ignition temperatures anywhere near or below 140°F indicates a very hazardous material. Auto ignition temperature is not related to the flash point, and the temperature range between these two points varies considerably from chemical to chemical.

## **SECTION V—HEALTH HAZARD INFORMATION**

This section provides information on the ways that the chemical may enter the body. The most important things to look for and understand when reading this section are the symptoms for chronic and acute exposure, and if the material has a local, systemic, or combination local and systemic effect on the body.

By recognizing both chronic and acute symptoms, the exposed person can be warned that there may be a breakdown in the measures the person has taken to protect him/her from exposure.

### **Health Hazards/Effects Of Exposure**

This section provides information on the health effects associated with overexposure. Both acute and chronic effects should be listed.

Many times there will be three listings, one each for eye, skin, and inhalation. Usually these will address local acute effects. In addition, toxicological information may also be given which will address the acute systemic effects as well as the chronic systemic effects.

Acute local and systemic effects can be reversible; chronic systemic effects are never reversible. Often this information will be the result of research and may be given in LD<sub>50</sub> or LC<sub>50</sub>.

### **Carcinogenicity**

This section will report as to whether NTP, IARC, or OSHA have listed the substance as a known or suspected cancer-causing agent. This section should always be addressed, even if only to establish the fact that a material is NOT a carcinogen.

### **Signs And Symptoms Of Exposure**

A summary of some general effects of acute exposure (dizziness, nausea, headache, etc.) will be listed here.

### **Medical Conditions Aggravated By Exposure**

The PELs are based on the effects a chemical will have on a healthy average worker. There is rarely any attempt to deal with the supersensitive person, who in some cases just should not be around a certain material. This section is very difficult and requires some insight in certain medical conditions that may predispose a person toward having problems when working with a certain material. As an example, asthmatic persons should not work around TDI.

Synergism, the ability of one material to greatly affect the toxicity of another material, may be discussed in this section. An example, if a person is exposed to large amounts of asbestos, his/her chances of asbestos related cancer triple. However, if the person smokes and is exposed to high levels of asbestos, the person has 95 times more chance of incurring asbestos related lung cancer.

### **Emergency And First Aid Procedure**

Based on anticipated effects, emergency and first aid procedures are recommended.

## **SECTION VI—REACTIVITY DATA**

This section describes any tendency or potential of the material to undergo a chemical change and release energy. Undesirable effects such as temperature increase and formation of toxic, corrosive, flammable gases, or by products due to heating or as a result of contact with other materials will be described here. DOT hazard categories noted in this section include, but are not limited to:

### **Explosives, Water Reactives, Oxidizers And Corrosives**

Other materials that should be noted in this section include plastic pre polymers and chemicals that are unstable, or unstable under certain conditions such as catalysts or strong reducing agents.

#### **Stability**

The ability of a material to remain unchanged during storage. Materials that can spontaneously generate heat, polymerize, expand, form a gas, or detonate should be noted in this section. A material can be unstable and not dangerous. For example, rubber may rot upon standing.

#### **Incompatibility**

A list of materials which should not be stored with this material due to the possibility of reactivity. Everything will react with something. In a good MSDS, the type of reaction that might occur and the by products of that reaction will be listed. Do not assume that because nothing is listed, that there are not incompatible materials.

#### **Hazardous Decomposition**

An indication of the relative hazards associated with decomposition of the material. With certain materials this section should provide information similar to that found in Section II. For example, nitric acid fumes decompose to NO<sub>2</sub>. NO<sub>2</sub> has a PEL, but this might not be listed in Section II. It should be listed here.

Another example is calcium hypochlorite, which has no PEL. In the presence of acid, hydrocarbons, ammonia, water, and even in the air, calcium hypochlorite will break down and release chlorine gas, which does have a PEL. Although this will not be listed in Section II, the PEL for chlorine gas should be listed here.

## **SECTION VII--SPILL, LEAK, AND DISPOSAL PROCEDURES**

### **Steps To Be Taken In Event Material Is Released Or Spilled**

Information in this section describes how to properly contain and handle the material in the event of spills or leaks. This section should include recommendations on clean up procedures and materials, and personal protective clothing including gloves and respirators.

#### **Waste Disposal**

This section contains the manufacturers recommended method for disposing of excess, spent, used, leaked, or spilled material. Since waste disposal laws now vary greatly



from state to state and from city to city, the local authority(s) should be contacted for recommendations on disposal. In San Francisco, call the Department of Public Health Hazardous Material Unified Program Agency (HMUPA) at 252-3900.

## **SECTION VIII—SPECIAL HANDLING INFORMATION**

### **Control Measures**

Recommendations are given regarding types of control measures and protective devices that may be necessary. Recommendations will include:

- Personal protective equipment (PPE) including respirators.
- Administrative controls such as limiting the time of exposure.
- Engineering controls such as ventilation systems.

Unless it is not feasible or the operation is so short and transitory that an engineering control is not reasonable, OSHA will require the engineering control as the method of worker protection.

## **SECTION IX—SPECIAL PRECAUTIONS**

This section should provide information regarding special measures for storage and/or handling, which were not covered in other sections.

Many manufacturers will provide information that is not required by law to be on the MSDS. Often, but not always, this information will be located in this section.

- DOT (Department of Transportation) Information such as required hazard labeling and placards.
- EPA (Environmental Protection Agency). Information including whether the material is considered a hazardous waste as defined by the EPA.
- Monitoring methods. The types of sampling equipment or sampling media necessary for measuring airborne concentrations of a chemical. Monitoring may be necessary to insure that the employee working with the material is in fact exposed to no, low, or safe levels of the chemical.
- Issue information. The date the sheet was issued or last updated, and the name and credentials of the person preparing the MSDS.

NOTE: Not all MSDS are written by experts, and no expert knows everything that should go on an MSDS. The law allows for information blanks where the information is not apparently available.

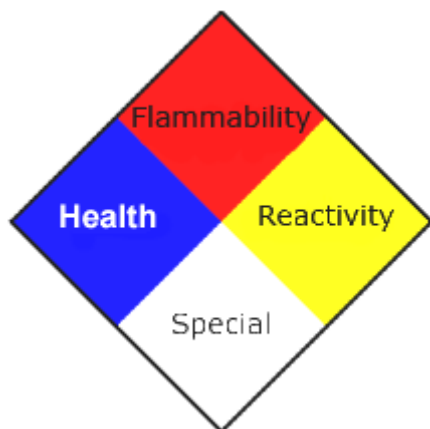
## APPENDIX F—NFPA IDENTIFICATION SYSTEM

The San Francisco Fire Department and Health Department require the posting of appropriate hazard warning signs and/or the posting of the National Fire Protection Association's 704 marking System diamond on stationary aboveground tanks and at the entrances to locations where hazardous materials are stored, dispensed, used or handled in quantities requiring a permit.

The Hazardous Materials Program at the Department of Public Health uses the following guidelines for posting markings and signs indicating hazardous materials locations within buildings:

- Not every area containing hazardous materials will have the NFPA 704 marking system diamond posted. For example, if only small amounts of office chemicals such as duplicating fluids or photo developers are present, a judgment may be made by an inspector as to whether the NFPA 704 marking is necessary.
- For very small amounts of chemical storage, such as janitor closets, a sign reading "Janitor Closet," "Cleaning Supplies," etc. is acceptable. Such plain English signs convey in practical terms the presence of chemicals.
- For the storage of several materials in a single hazard class, specific signs such as "Flammable Liquid" or "Corrosive" are requested. If a cabinet contains only one very specific class of chemicals, such as acids or bases, the cabinet should be labeled with the hazard class. This labeling procedure provides emergency responders with the specific hazard of the contents.
- A NFPA 704 marking diamond may not be requested on the outside of the building if the nature of the building is obvious, such as a service station or hospital. (Individual areas within a hospital would be posted.)
- As a rule, a blank NFPA 704 diamond is used for areas of mixed chemical storage where there are several hazard classes of chemicals in the same room or cabinet.
- A NFPA 704 diamond with the numbers filled in is normally used only for individual containers, unless a room or cabinet contains only a single hazardous material in which case the numbers on the 704 diamond indicating the degree of health, flammability, and instability will be filled in.
- If the area contains chemicals with special hazards, the bottom white portion of the 704 diamond will contain such information as "Water Reactive", "Radioactive", "Oxidizer", etc..

The National Fire Protection Association (NFPA) 704 standard system for the identification of the hazards of materials for emergency response identifies the hazards of a material in terms of three principal categories: “health,” “flammability,” and “instability.”



The hazard information is presented by four diamonds (square on point) comprising a larger diamond. The health rating is located at the nine o'clock position and has a blue background. The flammability rating is located at the twelve o'clock position and has a red background. The instability rating is located at the three o'clock position and has a yellow background. The fourth diamond at the six o'clock position has a white background and is reserved for special hazards.

The system indicates the degree of severity by a numerical rating that ranges from four (4), indicating severe hazard, to zero (0), indicating minimal hazard.

## HEALTH HAZARDS (BLUE)

In general the health hazard that results from a fire or other emergency condition is one of acute (single) short-term exposure to a concentration of a hazardous material. This exposure can vary from a few seconds to as long as one hour. For purposes of assigning the health hazard rating, only the inherent physical and toxic properties of the materials shall be considered, unless the combustion or decomposition products present a significantly greater degree of risk.

The degree of health hazard shall indicate to fire fighting and emergency response personnel one of the following: that they can work safely only with specialized protective equipment; that they can work safely with suitable respiratory protective equipment; or that they can work safely in the area with ordinary clothing.

A health hazard rating of four (4) indicates materials that, under emergency conditions, can be lethal. A rating of three (3) indicates materials that, under emergency conditions, can cause serious or permanent injury. A rating of two (2) indicates materials that, under emergency conditions, can cause temporary incapacitation or

residual injury. A rating of two includes materials that are respiratory irritants, cause irritating but reversible injury to the eyes, and materials that are primary skin irritants or sensitizers. A rating of one (1) indicates materials that, under emergency conditions, can cause significant irritation. This includes materials that are slightly irritating to the respiratory tract, eyes, and skin. A rating of zero (0) indicates materials that, under emergency conditions, would offer no hazard beyond that of ordinary combustible materials.

## **FLAMMABILITY HAZARDS (RED)**

The degree of flammability hazard is ranked according to the susceptibility of materials to burning. Since many materials will burn under one set of conditions but will not burn under others, the form or condition of the material should be considered along with its inherent properties.

A flammability rating of four (4) indicates materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air, and which will burn readily. A rating of four includes flammable gases, flammable cryogenic materials, and materials that ignite spontaneously when exposed to air. A flammability rating of three (3) indicates liquids and solids that can be ignited under almost all ambient temperature conditions. A three flammability rating includes materials that on account of their physical form or environmental conditions can form explosive mixtures with air and that are readily dispersed in air and materials that burn with extreme rapidity, usually by reason of self-contained oxygen. A flammability rating of two (2) indicates materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. This includes liquids with a flash point above 100oF and below 200oF and solid materials that burn rapidly but generally do not form explosive atmospheres with air. A flammability rating of one (1) indicates materials that must be preheated before ignition can occur. This includes most ordinary combustible materials. A flammability rating of zero (0) indicates materials that will not burn.

## **INSTABILITY HAZARDS (YELLOW)**

The degree of instability hazard shall indicate to fire fighting and emergency personnel whether the area shall be evacuated, whether a fire shall be fought from a protected location, whether caution shall be used in approaching a spill or fire to apply extinguishing agents, or whether a fire can be fought using normal procedures.

An instability rating of four (4) indicates materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures. A rating of three (3) indicates materials that in themselves are capable of detonation or explosive decomposition or explosive reaction, but that require a strong initiating source or that must be heated under confinement before initiation. This

includes materials that are sensitive to thermal or mechanical shock at elevated temperatures and pressures and materials that react explosively with water without requiring heat or confinement. A rating of two (2) indicates materials that readily undergo violent chemical change at elevated temperatures and pressures. This includes materials that react violently with water or form potentially explosive mixtures with water. A rating of one (1) indicates materials that in themselves are normally stable, but that can become unstable at elevated temperatures and pressures. A rating of one includes materials that react vigorously with water, but not violently and materials that change or decompose on exposure to air, light, or moisture. A rating of zero (0) indicates materials that in themselves are normally stable, even under fire conditions.

## APPENDIX G—HAZMAT TEAM TRAINING

Members of the SFFD HazMat Team consist of both fire and paramedic personnel. The fire personnel will have received the California Specialized Training Institute (CSTI)/State Fire Marshal certification as Hazardous Materials Specialist prior to their assignment to the team. This currently entails 240 hours of training through a CSTI certified instructor. The paramedic personnel will have received the California Specialized Training Institute (CSTI)/State Fire Marshal certification as Hazardous Materials Industrial Technician prior to their assignment to the team. The certification entails at least 24 hours of training through a CSTI certified instructor.

### MEDICAL EXAMINATIONS

Due to the nature of their assignment, HazMat Team personnel have a mandated medical surveillance program. The employer shall make medical examinations and consultations available to each employee:

- Prior to assignment.
- At least once every twelve months for each employee covered unless the attending physician believes a longer interval (not greater than biennially) is appropriate.
- At termination of employment or reassignment to an area where the employee would not be covered if the employee has not had an examination within the last six months.
- 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.
- 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.
  - As soon as possible following the emergency incident or development of signs or symptoms.

- At additional times, if the examining physician determines that follow up examinations or consultations are medically necessary.<sup>9</sup>

**END**

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<sup>9</sup> 29CFR 1910.120 (f)(3)(i)