

Chapter 10

Fire-Fighting Operations Involving Explosives

10-1. This chapter addresses the basic knowledge that firefighters need to handle incidents when munitions, ordnance, or chemical weapons are involved in a fire. The chapter will show the various types of warning signs/placards, how to mark ordnance, and what ordnance should look like. Emergency procedures on when to fight such fires or when to evacuate will be discussed. The last section will cover UXO. In recent operations, lack of knowledge and/or training about UXO has killed more soldiers than the enemy has. Whether at an incident or responding to one, firefighters need to know how to report UXO.

RESPONSIBILITIES

COMMANDERS

10-2. All commanders are responsible for preventing accidents involving personnel operations and activities under their jurisdiction. They are responsible for storing and transporting nuclear, chemical weapons and munitions, and any other HAZMATs. Commanders will ensure that—

- Personnel who handle and transport HAZMATs understand the procedures to initiate when spills, leaks, fires, and other emergencies occur. Chapter 11 details procedures personnel should use in HAZMAT fires.
- Fire departments in the mutual-aid agreement chain are informed of the type of situation that they are responding to and the procedures to use at the scene.
- SOPs address nuclear, chemical, and HAZMAT control and movement, fire-equipment placement, exposure control, and evacuation procedures.

FIRE DEPARTMENTS

10-3. Fire departments provide C^2 , fire extinguishment, and HAZMAT stabilization at an emergency site. After controlling an emergency, fire-department personnel monitor the cleanup operations to prevent further life or property loss.

SUPPORT AGENCIES

10-4. Fire departments are not equipped to handle large HAZMAT emergencies. They will need assistance from many of the following:

- Bioenvironmental engineer.
- Base environmental coordinator.
- NBC section personnel.

- Containment and decontamination personnel.
- Medical personnel.

FIRE DIVISIONS

DIVISION 1

10-5. Division 1 deals with Hazard Class 1.1 materials, which are explosives and liquid propellants. The primary hazard is mass detonation. The Department of Transportation (DOT) classifies this division as explosive Class A. When dealing with this hazard, firefighters—

- Perform rescue operations before extinguishing a fire.
- Attempt to extinguish a fire if nonexplosive and explosive materials are separated or if the fire chief approves extinguishing procedures.
- Take protective cover if personal safety is in jeopardy.

DIVISION 2

10-6. Division 2 deals with Hazard Class 1.2 materials, which are fragmentation ammunition and explosives. The primary hazard is explosion with fragments. When dealing with this hazard, firefighters—

- Fight a fire when possible. If not possible, they prevent it from spreading.
- Provide protection from fragments because such items could detonate.

DIVISION 3

10-7. Division 3 deals with Hazard Class 1.3 materials, which are ammunition and explosives. The primary hazard is mass fire. The DOT classifies this division as explosive Class B. When dealing with this hazard, firefighters—

- Fight the fire, if explosives are not directly involved.
- Immerse the white phosphorus (WP) in water or continuously spray it with water if WP ammunition is involved.
- Apply dry sand or dry powder if hexachloroethane (HC) and incendiaries are involved.
- Allow magnesium to cool if pyrotechnics and magnesium incendiaries are involved and if the magnesium is not on flammable materials. If the magnesium is on flammable materials, they spread a 2-inch layer of dry sand or powder on the floor, rake the burning material onto the layer, and mix them together. They protect the adjacent facilities and equipment. Firefighters will not use carbon dioxide (CO₂), Halon extinguisher, or water.

DIVISION 4

10-8. Division 4 deals with Hazard Class 1.4 materials, which are ammunition and explosives. The primary hazard is moderate fires without a blast hazard. When dealing with this hazard, firefighters—

- Fight the fires.
- Should be aware that minor explosions could occur, resulting in the release of hot fragments.

FIRE SYMBOLS

10-9. Figure 10-1 shows the fire symbols that identify the fire divisions. The background color is orange, and the number that identifies the division is black. The symbol color follows the DOT labels and placards for explosive Classes A and B. Symbols indicating special hazards, such as toxic chemicals and nuclear weapons, are displayed in addition to the fire symbols.

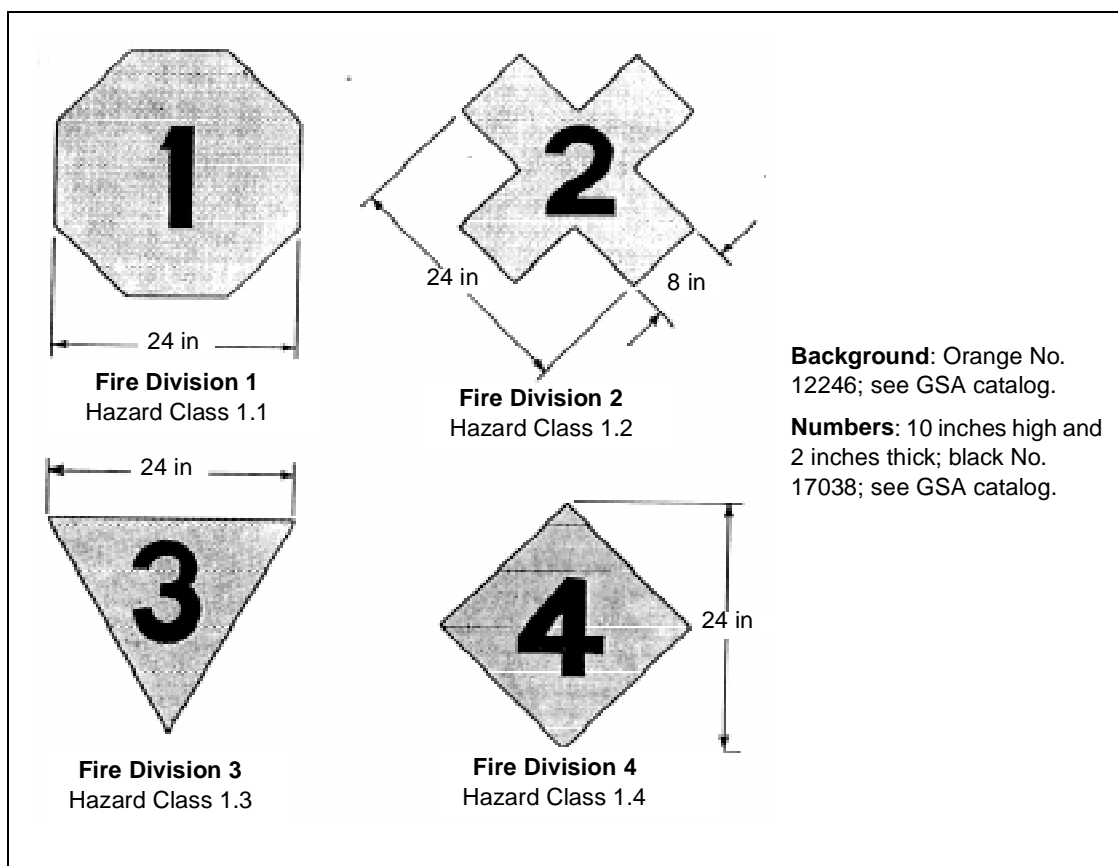


Figure 10-1. Fire symbols

10-10. Fire symbols are displayed on the exterior of buildings and storage sites containing explosives or ammunition. Removable placards or boards showing the symbols may be used on buildings or storage sites in which explosive contents frequently change. The symbols must be visible to

approaching fire-fighting crews from the maximum practicable distance. Fire symbols are not required on earth-covered magazines or on outdoor riveted sites restricted to storing hazard Class 1.1, (18)1.2, (12)1.2, and (08)1.2 materials. However, for safety, commanders may designate blocks in earth-covered magazines as areas containing HAZMATs and may require the display of the appropriate fire symbol.

10-11. Warehouses and other facilities used for storing empty explosive containers that have not been decontaminated will display a division 4 symbol. Buildings containing radioactive materials will use the standard radiation symbol described in 10 Code of Federal Regulations (CFR) 20.1901 and 20.1902.

10-12. While on Army installations, all railroad cars and vehicles containing ammunition, explosives, and HAZMATs must display a fire symbol. Installation railroad cars and vehicles not destined for movement off the installation shall display at least two fire symbols. Installation transport vehicles destined for shipments off the installation, commercial railroad cars, and motor vehicles will display placards according to DOT regulations when containing ammunition or explosives. Fire symbols or placards are placed on all transport vehicles before loading and are removed after unloading. See Figures 10-2 and 10-3 for placard locations on railcars and vehicles.

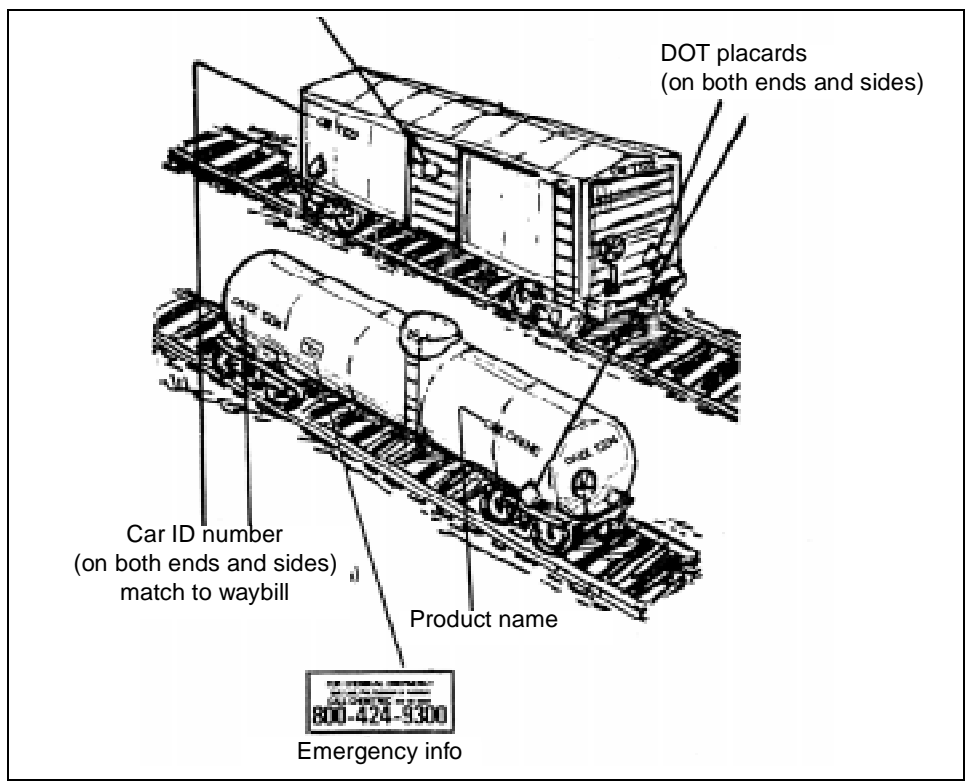


Figure 10-2. Placard placement on railcars

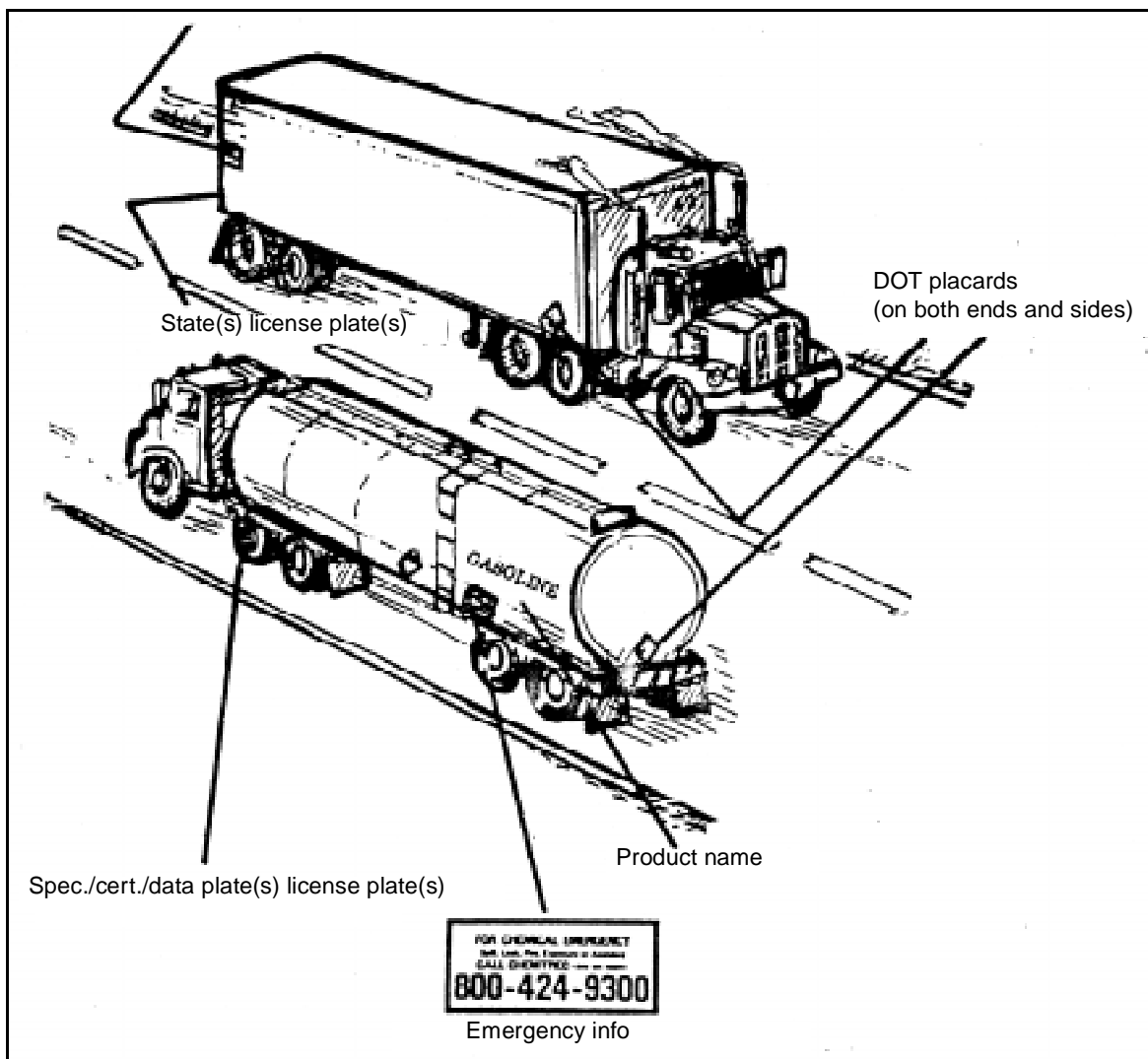


Figure 10-3. Placard placement on trucks

10-13. When the fire symbols or topography- and vegetation-shield symbols are not displayed on structures, maintain a master list or map indicating the storage-site locations, fire and chemical symbols, and empty sites. Update and post this list or map at all the entrances, control stations, and control points servicing the storage location. Fire-fighting, guard, and emergency forces should have a copy of this list or map. This provision for lists and maps does not apply to chemical agents and chemical-munitions storage and operating facilities. The personnel in charge of HAZMAT storage or shipping are responsible for changing the fire symbols or DOT placards when necessary.

CHEMICALS

10-14. Storage and operating facilities and vehicles that deal with chemical agents and munitions will display the appropriate chemical-agent symbol. Figure 10-4 shows the chemical-hazard symbols. The color of symbol 1 (Figure 10-4) will indicate which set of protective clothing that fire crews must wear. Symbol 2 (Figure 10-4) is posted when there is a presence of incendiary and readily flammable chemical agents. This symbol indicates that fire crews must wear breathing apparatus. Symbol 3 (Figure 10-4) is a warning against extinguishing a fire with water. A dangerous reaction will occur if water is applied. This symbol may be posted with other symbols, if required.

10-15. Below is a description of the chemical-symbol sets. If fire crews are equipped with heat-resistant bunker gear and a protective mask or a SCBA, they do not need the protective clothing identified in sets 2 and 3 when fighting fires involving materials identified in these sets.

- Set 1. The symbols in this set have a blue background and a red rim and figure. The symbol indicates the presence of highly toxic chemical agents that may cause death or serious damage to bodily functions. Fire crews must use the M9 protective mask or SCBA and impermeable suit (hood, boots, undergarments, coveralls, gloves, and protective footwear).
- Set 2. The symbols in this set have a blue background and a yellow rim and figure. The symbol indicates the presence of harassing agents (riot-control agents and smokes). Fire crews must use the M9 protective mask or SCBA, coveralls, and protective gloves.
- Set 3. The symbols in this set have a blue background and a white rim and figure. The symbol indicates the presence of WP and other spontaneously combustible materials. Fire crews must use the M9 protective mask or SCBA and flame-resistant bunker gear.

10-16. Table 10-1, page 10-8, shows the chemical agents most used in ammunition and the combinations of chemical-hazard symbols that are required on chemical-storage facilities.

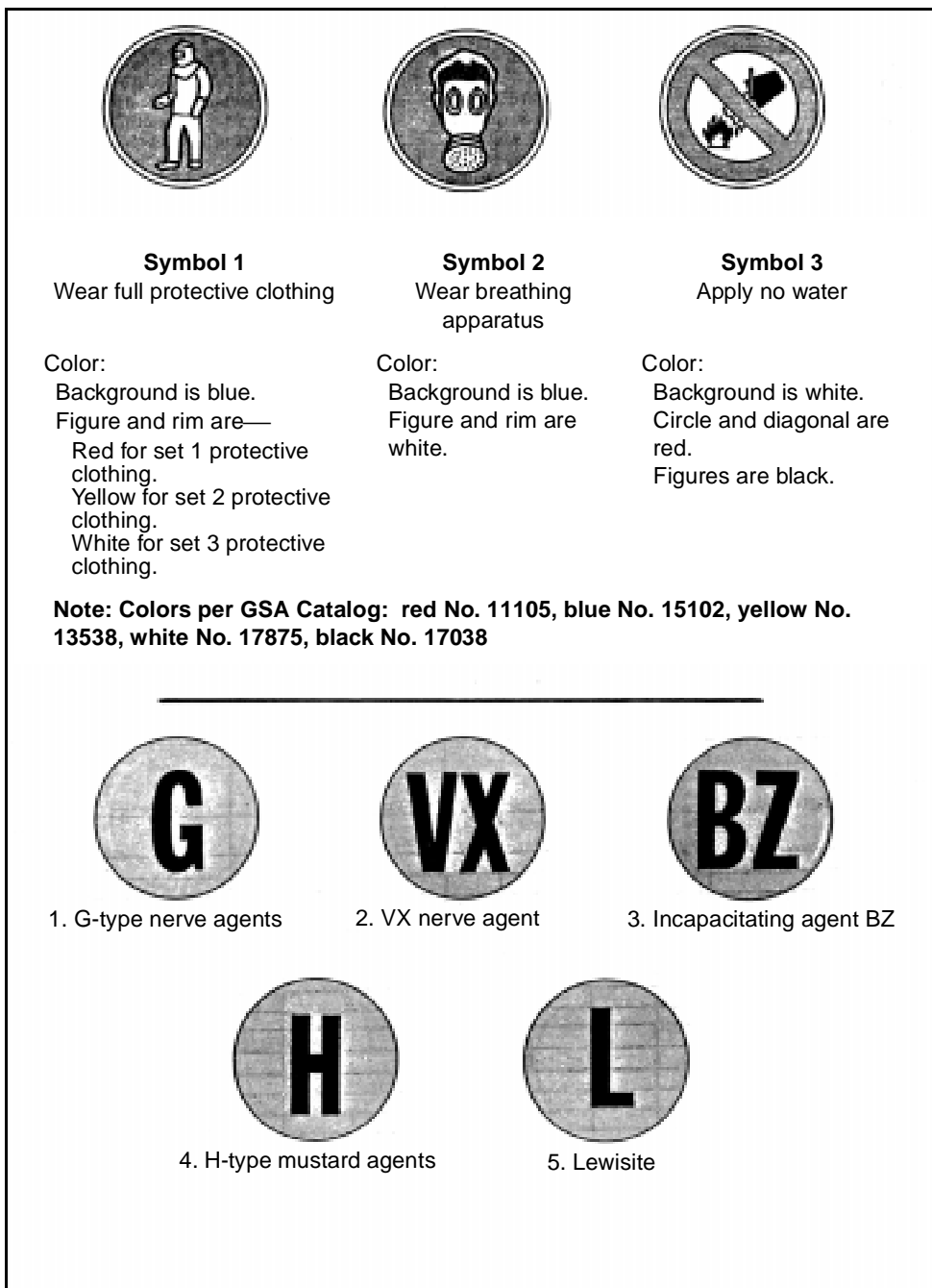


Figure 10-4. Chemical-hazard symbols

Table 10-1. Chemical agents used in ammunition

Chemical Agents and Fillers in Ammunition	Full Protective Clothing			Breathing Apparatus	Apply no Water	G	VX	BZ	H	L
	Set 1	Set 2	Set 3							
	GB	X								
VX	X						X			
H, HD, HT	X								X	
L	X									X
CL, CG, CK, CN, CNS, CS, BBC, DA, DC, DM, FS, FM		X								
HC				X	X					
BZ		X						X		
WP, PWP			X							
TH, PT				X	X					
IM, NP				X						
TEA, TPA			X		X					
Colored smokes				X						

FIRE-FIGHTING PROCEDURES

10-17. How to fight a particular fire will depend on the type of ordnance involved, how long the fire has been burning, how large the fire is, how long the ordnance has been exposed to the fire, and whether or not any personnel are trapped. The SFO must make a quick, accurate decision. However, any decision that he makes must ensure the crew's safety above all considerations.

AMMUNITION AND EXPLOSIVES

10-18. The fire crews must know the specific reactions that occur when ammunition and explosives are exposed to heat or fire. They must be informed of the known hazards and conditions that exist at a fire scene before proceeding to a fire. Ammunition fires containing explosives and chemical agents require special precautions. The crews will follow the procedures for the fire division covering the materials involved in a fire.

Divisions 1 and 2

10-19. Materials in these divisions could detonate, causing a moderate-to-severe fragmentation hazard. The fire crews will not approach the area closer than 1,000 feet for every 50,000 pounds of explosives involved in a fire. Mobile equipment will be kept at a protected location. The fire chief and SFO of the responding unit determine if the facility is safe to approach. They agree on procedures and then direct fire crews on how to approach the facility and

extinguish a fire. The same procedures apply to protecting adjacent buildings from fire.

Division 3

10-20. Fires involving materials in this division produce wide-spread, intense radiant heat that is dangerous to personnel and equipment. If a fire is minor and controllable, fire crews will confine operations to preventing it from spreading to other buildings.

Division 4

10-21. Generally, materials in this division present only a fire hazard. The fire crews fight a fire with portable and mobile fire-extinguishing equipment until it is extinguished.

CHEMICAL WEAPONS

10-22. Chemical weapons are designed to cause injury, disability, or death from skin contact, inhalation, or ingestion of chemical agents. Responding crews must approach the emergency scene cautiously. The success of a chemical-rescue operation will depend on the—

- Knowledge that the fire crews have about chemical-weapons procedures.
- Training that personnel receive using rescue equipment.
- Implementation of suggested changes or improvements that result from discussions about chemical incidents.

10-23. Chemical weapons contain flammables or explosives that propel and disseminate the chemical agent. When exposed to high heat, the agent is consumed and dissipated; however, responding crews cannot accurately determine if a fire has consumed the chemical. Therefore, they must assume that these chemicals are present and must use extreme caution when in or near the smoke from such chemical fires. Military installations that routinely handle chemical weapons will have teams or fire-rescue personnel trained and equipped to perform rescue and decontamination operations. Most fire departments will have HAZMAT teams to assist when necessary.

10-24. The chemicals in weapons are stored as a solid, liquid, or gas but are disseminated as a gas. Therefore, fire crews may not see spills or agents on the ground. They must recognize the symptoms of chemical contamination. The five basic categories of chemical agents and the exhibited symptoms of exposure follow:

Nerve Agents

10-25. Nerve agents are designed to cause death or disability by disrupting the voluntary nervous system (arms, legs, and throat) and the involuntary nervous system (eyes, lungs, and heart). The agents are inhaled or absorbed through the skin. Symptoms include pinpointing of the pupils, tightness of the chest, runny nose, vomiting, and diarrhea, followed by total paralysis and death.

Blister Agents

10-26. Blister agents cause severe blistering, disability, and injury to mucous membranes (mouth, throat, lungs, and eyes). The liquid or fumes of blister agents are inhaled or absorbed by the skin. Symptoms include formation of blisters in the lining of the mouth, throat, and lungs.

Blood Agents

10-27. Blood agents inhibit the blood from using and transporting oxygen to muscle and tissue. Blood agents are absorbed through the skin. Symptoms include disruption of the victim's metabolism and eventual suffocation.

Choking Agents

10-28. Choking agents, which are inhaled, cause inflammation of tissues and of the air passageways. Symptoms include restricting and narrowing of the air passageway, causing the victim to choke.

Riot-Control Agents

10-29. Riot-control agents cause eye irritation and skin burns. The agents are absorbed through the skin. Symptoms include burning sensations and excessive tearing. When notified of a chemical accident, the responding crews will don SCBA and rubber suits, if available. If this equipment is not available, the crews will don full turnout clothing. When turnout clothing is used, access to contaminated areas is restricted.

10-30. The responding crews will advance to the emergency site using the most direct route, keeping in mind wind direction, temperature, and other weather conditions. The fire crews should approach a fire from the upwind side to minimize their exposure. If winds are low or variable, the hazardous areas will be broad. If winds are high, the hazardous areas will be narrow, but will extend further downwind.

10-31. At the scene, the technical advisor determines the action of the responding crews. If a rescue or life-threatening situation does not exist, the fire crews' actions will be to evacuate personnel and prevent a fire from spreading to other areas. If rescue is necessary and the fire crews have adequate protection, they enter the site from the upwind side and cover burning materials with AFFF before attempting rescue operations. When rescue is possible, the rescue personnel—

- Locate the victims.
- Wash the victims' faces with plain water.
- Move the victims to a safe, upwind location.
- Examine the victims for injuries and agent symptoms.
- Wash the victims' open wounds with clear water and cover them with an uncontaminated dressing.
- Release the decontaminated victims to the medical personnel.

10-32. After completing rescue operations, all fire-department personnel will remove their contaminated clothing and wash or shower, using a 5-percent bleach-in-water (HTH) solution. They will check each other for agent

symptoms. No personnel or clothing will be allowed from a site until the commander's technical representative certifies that the clothing and personnel have been decontaminated.

NUCLEAR WEAPONS

10-33. DA policy states that fire personnel should continue to fight a nuclear-weapons or nuclear-components fire as long as they can—

- Prevent loss of life or serious injury.
- Prevent contaminants from scattering, especially plutonium.
- Save burning aircraft, vehicles, and structures and any nuclear contents.
- Prevent property or material damage.

10-34. Nuclear weapons are designed to prevent nuclear yield if accidentally detonated. However, nuclear weapons can yield nuclear material if the mass of nuclear material receives even compression by the detonation of surrounding high explosives. The high explosives and nuclear material are the most hazardous components of nuclear weapons. Other components may produce hazards; however, precautions taken against the high explosive and nuclear materials adequately cover other components.

10-35. Burning high explosives have certain characteristics that fire crews should recognize. The high temperature that oxidizes the explosive causes torching (a hot, forceful flame from burning petroleum fuels or other materials). The smoke of burning explosives has a lighter color than the smoke of other burning fuels. As high explosives burn, they melt and drip, flow, spread, and mix with surrounding materials. High explosives can pick up impurities that make them more dangerous than before they melted.

10-36. Nuclear materials disperse as finely divided particles when the high explosives in the weapons impact or detonate. The nuclear materials in the weapons disperse as oxides if they burn. These particles and oxides are alpha emitters that have very short ranges and cannot pierce the skin. When particles or oxides are suspended in the air, they can be swallowed or inhaled or absorbed through cuts in the skin (a more dangerous source of entry into the bloodstream).

10-37. Inhaling oxidized nuclear material is the principal method by which personnel are contaminated. The hazards are reduced once the particles settle to the ground. Fire crews must be careful not to disturb these particles once they have settled. If they must enter a contaminated area, they should—

- Occupy the area as little as possible.
- Use the SCBA or respirators and wear protective clothing.
- Use a wet handkerchief over their nose and mouth if the SCBA or respirators are not available.

10-38. In any nuclear-weapons emergency, the first priority is to evacuate all nonessential personnel. The minimum clearance distance is 3/4 mile. The SFO assesses the situation and decides whether to fight a fire, maintain fire-fighting efforts, or withdraw from the scene. The amount of time available to

fight a fire varies from a few minutes to an indefinite period, depending on the weapon casings and the intensity and proximity of the fire to the nuclear weapons.

10-39. When possible, fire crews should cool the weapons while controlling a main fire. Water is the most effective agent for cooling. If the available water supply is adequate, they may be able to cool the weapons and extinguish a main fire simultaneously. If the water supply is not adequate for both operations, fire crews should use other agents, such as AFFF, to cool the weapons. The disadvantage of AFFF is that it conceals the extinguished but dangerous residue. If the nuclear weapons are in an area adjacent to a fire, fire crews must try to cool the weapons while extinguishing the fire. If the water supply is not adequate to cover both operations and the weapons are in an area where heat absorption is minimal, they should extinguish the fire.

10-40. When an explosion is imminent, fire crews must withdraw to an area at least 2,000 feet from the fire. They must not attempt to fight the fire. After fire crews do extinguish a fire, they should withdraw to a minimum distance of 2,000 feet from the fire area. Trained disposal and decontamination teams will be the only authorized personnel allowed in the fire area to monitor the activity of the nuclear weapons. All fire personnel and equipment that may be contaminated from the smoke of burning nuclear weapons will be isolated in a separate area. Trained teams will monitor the fire personnel and equipment and release them after decontamination is completed.

10-41. The military services and the Energy Research and Development Administration (ERDA) maintain trained teams. These teams are responsible for and equipped to detect radiation, neutralize weapons, and decontaminate areas containing explosives or nuclear materials. When the military or ERDA is notified of a nuclear-weapons accident, they will dispatch any of the following to the accident area:

- Nuclear emergency teams.
- EOD detachments.
- Radiological-contamination (RADCON) teams.
- Alpha teams.
- Radiological emergency medical teams (REMT).

10-42. On the battlefield, one common hazard is the UXO emergencies that fire-fighting units will respond to as the EOD units conduct their UXO reconnaissance. Because of this, fire-fighting units must coordinate with EOD before entering an area that is contaminated with UXO.

UNEXPLODED ORDNANCE

DROPPED MUNITIONS

10-43. Dropped munitions are those munitions that are dropped by high-attack aircraft or by helicopter. They may be designed to explode on impact or as an airburst, or they may lie in place until disturbed. Dropped types of UXO include the following subgroups:

- Bombs—includes general purpose; demolition; rocket-assisted, armor-piercing; fragmentation; chemical; fire; incendiary; and smoke bombs.
- Submunitions—includes mines and grenades.

PROJECTED MUNITIONS

10-44. Projected munitions are fired by artillery, rockets, or mortars. They may be designed to explode on impact or as an airburst, or they may lie in place until disturbed. Subgroups of projected munitions include the following:

- Projectiles—includes artillery, fine-stabilized, and rocket-assisted projectiles.
- Mortars—includes high explosives, illumination rounds, and WP/smoke rounds.
- Rockets.
- Guided missiles.
- Rifle grenades.

THROWN AND PLACED MUNITIONS

10-45. Thrown munitions are commonly referred to as hand grenades. They are classified as fragmentation, offensive, antitank, smoke, and illumination. Placed munitions are referred to as land mines. The two types are antipersonnel and antitank.

UXO HAZARDS

10-46. UXO is a hazard to a fire-fighting team because it can kill people and destroy objects, or it may delay a team's response to an emergency, thus causing more destruction. Fire-fighting crews must be observant of response routes and of the AO, especially when responding during or immediately after an attack. Vehicle operators must be aware of all the activities occurring around the vehicle at all times. Crews must watch the entry and exit points for any signs of placed charges set to inflict injuries or death to emergency crews. UXO hazards may also be present at aircraft incidents. The munitions may be scattered on the area of the incident from the impact.

UXO SPOT REPORT

10-47. When crews encounter UXO, their first action should be to stay clear of the area and report to the higher command. An UXO spot report will contain

as much of the following information as possible and be forwarded to the supporting EOD team(s) by the most expeditious means available:

- Line 1—date/time group.
- Line 2—reporting activity unit identification code (UIC) location (grid).
- Line 3—contact method (radio frequency, call sign, phone number).
- Line 4—type of munitions (dropped, placed, projected, thrown).
- Line 5—NBC contamination.
- Line 6—resources threatened.
- Line 7—impact on mission.
- Line 8—protective measures taken.
- Line 9—recommend priority (immediate, indirect, minor, no threat).