



*Sidney F. Pitts
Conoco Chemicals
Westlake, La. 70669*

EMERGENCY HANDLING OF HAZARDOUS MATERIALS IN SURFACE TRANSPORTATION

**Edited by
Patrick J. Student**

**Bureau of Explosives
Association of American Railroads
1920 L Street, N.W.
Washington, D. C. 20036**

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**BUREAU OF EXPLOSIVES
NEW 24-hour EMERGENCY PHONE
202-835-9500**

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Thomas A. Phemister, Director**

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NOTICE TO USERS

The material in this book was prepared by the Bureau of Explosives staff in 1981 from sources and from experience deemed reliable and accurate. As with all information prepared for emergency response, especially emergency response involving hazardous materials, the printed word cannot substitute for the informed judgment of those responsible on the scene. Only they can accurately assess the scope of damage to equipment, hazardous lading lost and the potential for further harm in the immediate post-accident environment. It is vital to understand that each occurrence is different and each must be handled as the unique situation which it represents.

Accordingly, while the Bureau of Explosives stands ready to offer the considerable help and expertise at its disposal, no claim can be made that the information in this book, or the advice rendered on scene by Bureau personnel, will always insure the complete safety of persons or property involved in an emergency arising out of the transportation of hazardous materials. With 75 years of experience in this business, the Bureau of Explosives would be suspicious of any person or organization making such a claim.

Actions recommended or discussed in this book are aimed at handling an immediate emergency situation and may not detail all the potential hazards of the materials involved. This is especially true where several materials may have become mixed because of multiple leaks or container ruptures. Expert advice and assistance should be obtained and followed as quickly as possible. An excellent source of first response advice is

CHEMTREC (800) 424-9300

(in the District of Columbia, call 483-7616).

(in Alaska, Hawaii and Canada, call (202) 483-7616)

The CHEMTREC communicators can often put those on scene at an emergency in touch with the shipper of the product(s).

Thomas A. Phemister
Director, Bureau of Explosives
Washington, D.C.
September 30, 1981

BASIC ORGANIZATION OF THIS BOOK

Emergency Handling of Hazardous Materials in Surface Transportation is divided into two primary sections.

The first section presents general information about hazardous materials incidents; it deals with general recommendations first and then with each DOT hazard class. Hazard class information is arranged in the order in which, historically, commodities of that class have been involved in accidents. Thus, flammable gases are discussed well before explosives because there have been more accidents involving them.

The first section also defines or explains the various terms used in the specific commodity information. For instance, if the reader is advised to "wear self contained breathing apparatus" or to "use water in flooding quantities as fog," these terms are explained toward the end of the first section under the heading "An explanation of terms used for emergency responders."

The second section gives commodity specific emergency response information for each hazardous material regulated by the U.S. Department of Transportation and listed in Title 49 of the Code of Federal Regulations. For Environmental Protection Agency designated Hazardous Substances, this section also gives commodity specific emergency environmental damage mitigation information.

At the back of this book are two cross reference indices. One shows the DOT-required 4-digit number and the product(s) and page(s) to which that number applies. For many commonly shipped materials, one DOT 4-digit number may apply to numerous commodities. The other cross reference index shows the 7-digit Standard Transportation Commodity Code number (the STCC number), the particular commodity to which that number applies and the page number on which information about that commodity appears. As additional information, the STCC cross reference index is preceded by an explanation of the 49-series format.

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EMERGENCY HANDLING OF HAZARDOUS MATERIALS IN SURFACE TRANSPORTATION

INTRODUCTION

When accidents or fires occur in connection with the transportation of hazardous materials, the first priority is the prevention of fatalities and injuries to people. The prevention of unnecessary damage to property and of injury to livestock, wildlife and the environment is the second priority.

To handle an incident in the safest manner, it is absolutely necessary to know the properties of the materials and of the shipping containers involved. Actual methods and procedures used may vary depending on local conditions.

The material in this book should be reviewed before an incident occurs; and should, ideally, be part of training and pre-planning exercises.

RECOMMENDATIONS FOR RESPONSE (GENERAL RULES)

It is entirely possible that the scene of an accident involving hazardous materials will represent such a high degree of hazard that the only safe course is to protect the perimeter and evacuate those who may become exposed to the dangers of violent ruptures of containers or of toxic fumes. These severe hazards may exist with or without the presence of fire, smoke or fumes.

If an accident involving hazardous materials happens, IMMEDIATELY:

1. Notify local emergency response authorities and, if possible, the transportation carrier.
2. Make an initial survey of the scene, determining:
 - the location of threatened or potentially threatened people,
 - the presence of fire, smoke or fumes,
 - the presence of hazardous materials,
 - the overall condition of the vehicles and containers,
 - wind direction and approximate speed; and
 - the condition of the terrain, including presence of water sources and supplies.
3. Rescue the injured, if possible. Wear the maximum degree of protective equipment practicable. Plan an escape route before entering the immediate area. Do not expose personnel unnecessarily to smoke and fumes.
4. Identify the specific products, cars, trailers or containers involved. Identify also the "hazard class" of all products involved. The train crew (or truck driver) will have shipping papers containing this information. In a rail yard or truck terminal, the papers are usually in the yard office or dispatcher's office. Placards applied to vehicles and/or labels on packages may help identify the presence or absence of hazardous materials, but the shipping papers are the best source of on-scene identification information. If the shipping papers and/or placards or labels are destroyed, the number on the rail car or motor vehicle can often be used to secure the name of the commodity being carried. Rail car numbers (or reporting marks) are a series of letters followed by a series of numbers, as in the following example: ABCX 12345. Many tank trucks use a similar numbering pattern. With this number, the carrier, or, in some cases, CHEMTREC (telephone number below) will be able to determine the contents of the vehicle.

Using the second section of this book, identify and learn the dangerous characteristics of the hazardous materials involved and the generally applicable emergency response in-

formation. (If the only available commodity information is the 4-digit number on a vehicle placard or a Standard Transportation Commodity Code (STCC) number on a shipping or movement document, cross reference indices at the back of this book will help locate emergency response information. Placards on vehicles and labels on packages may also contain a single number at the bottom "point." This is a "hazard class" number assigned by the Intergovernmental Maritime Consultative Organization (IMCO). A list of IMCO numbers and their general class assignments appears with the cross reference indices at the back of this book.) Use this information to plan evacuations, mitigation activities, personnel safety and ultimate clean up.

5. Do not release any product(s) from containers or attempt to ignite or detonate either the products or the containers without expert advice and assistance.
6. If it is necessary to drag rail cars or other transport vehicles as a part of accident clearing operations, it should only be done with the expert advice and assistance of persons trained in and familiar with such techniques.

7. An accident in a tunnel involving a release of hazardous materials creates a greater risk than one in an open area, because the vapors are not readily dissipated and because a fire may exhaust the air otherwise available for breathing. Damage to the tunnel structure, caused by the accident or during its aftermath, may also cause the tunnel to cave in.

Conditions will vary greatly depending upon the drainage and ventilation of the tunnel, its length, the location of the accident and the response equipment available. In any event, close attention must be given to the risk of suffocation, and to the fire and explosion hazard in the tunnel.

Self contained breathing apparatus should be used, because gas masks are equipped only with a filtering device and are not designed for service in areas with insufficient oxygen.

Approach the wreckage from the windward end if possible. At least two persons should enter an area where vapors are concentrated, so that if one is overcome the other will be able to bring him/her out.

Monitoring devices to detect explosive mixtures, toxic fumes and oxygen deficiency should be used as part of the initial survey of a tunnel accident. Continual (or frequent) monitoring for the presence of these dangerous conditions is also essential.

8. The shipper(s) should be contacted for additional information on the product(s) involved. Additional emergency response assistance is available from:

CHEMTREC (800) 424-8300

In the District of Columbia, call 483-7616.

In Alaska, Hawaii and Canada call (202) 483-7616.

Puerto Rico and the Virgin Islands can use the "800" number.

In many cases, the CHEMTREC communicator will be able to establish direct contact with the shipper(s) of the product(s) involved.

The BUREAU OF EXPLOSIVES (202) 293-4048 (especially for hazardous materials involving railroads). An up-to-date, free list of Bureau of Explosives' inspectors and their locations throughout the United States and Canada may be obtained by writing:

The Bureau of Explosives

Association of American Railroads

1920 L Street, N.W.

Washington, D.C. 20036

If you have the following information when you call, help will be able to reach you much faster:

1. Your name, location and telephone number
 2. Location of the incident
 3. Carrier involved
 4. Vehicle reporting marks (Car or truck numbers)
 5. Placard/label applied
 6. Name of commodity and shipper
 7. Accessibility
 8. Weather conditions
 9. Local population information
 10. Topographical features
 11. Availability of water
9. Be aware that there are legal requirements to report hazardous materials accidents to many agencies including the U.S. Department of Transportation—EPA/Coast Guard National Response Center.

- * All carriers must make immediate report to the DOT/ National Response Center at (800) 424-8802 (in the District of Columbia, call 426-2675) of any incident in which hazardous materials are responsible for death, serious injuries, property damage in excess of \$50,000, or continuing danger to life and property.
- * All releases of hazardous material (and releases of radioactive materials or their involvement with fire) must be reported on Form F5800.1 to the DOT within 15 days of discovery. Releases of radioactive material are also subject to Nuclear Regulatory Commission and Department of Energy reporting requirements. The telephone numbers (and regional offices of the DOE) are given in the section on radioactive materials which appears later in this portion of the book.
- * Rail carriers, in addition, should report all serious incidents to the Bureau of Explosives. Phone (202) 293-4048. The Bureau should receive a copy of all F5800.1 reports submitted to the DOT by rail carriers.

RECOMMENDATIONS FOR RESPONSE (KEYED TO DOT HAZARD CLASSES)

FLAMMABLE GASES

GENERAL Flammable gases are often ignited immediately following a breach of their container. If not, the vapors can and often do flow until an ignition source—such as a highway flare or a hot exhaust manifold—is reached. When this happens, the entire cloud can catch fire almost at once. A gas leak that has ignited should not be extinguished unless the leakage can be stopped. Attempts to shut off the supply should be made only under streams of water to keep the metal cool. Let the gas burn if the valves cannot be closed. Tanks in intense fires, or exposed to flame impingement, especially if it is "torch-like," may rupture violently, producing a large fireball (up to 1800 feet across) and may hurl even large fragments nearly half a mile.

Additional information about these materials will be found in the detailed commodity section which follows. This information should be consulted when assessing the danger of an accident situation involving these materials.

IF ON FIRE If a flammable gas car is burning at the safety valve, manway cover, product valves or at a hole in the tank and the flames are not impinging on another car, there is relatively little risk of violent rupture of that tank from such a fire. Under such conditions, allowing the car to burn itself out has proven a safe course, even though the flames may burn for an extended time—perhaps several days. Allowing the nonburning vapors to spread may cause a sudden, violent, flash fire as noted earlier. Cars which are punctured and have burned out often have enough vapor left in them to create an explosive mixture in the tank. The tank must be purged when the fire goes out. One way to accomplish this is to flood the tank with water.

VAPORS Flammable gas shipped in single unit tank cars is shipped as a liquified gas. This is important to know because these liquified gases will vaporize under normal conditions and produce 200 to 600 volumes of vapor for each volume of liquid. The flammability range, a factor which varies for each material, is also an important factor. Some of these gas vapors are flammable in mixtures as lean as 2%; in other words, vapor diluted by 50 volumes of air to 1 volume of vapor could be flammable.

Flammable vapors released from an opening in a tank car cannot be confined and will ignite upon contact with any spark, flame or other sufficient heat source and will burn with great rapidity, violence, and intensity back to the opening from which the vapor originated. After the flash of fire, the gas will burn above the surface of the liquid or at the point of discharge. If liquid or vapor is released from a tank car, all sources of ignition must be kept away from it or any area where the vapor concentration is at or above the Lower Explosive Limit (LEL). Explosimeters or other detectors are available to check for dangerous concentrations. If tank cars are breached or ruptured in a derailment, all people and power equipment should be kept at least 2500 feet away until the boundary of the LEL is known. Continual monitoring of the LEL boundary is required until the discharge is stopped and the vapors are known to have dispersed.

Take these steps to avoid setting the vapors on fire:

1. Extinguish all fires, smoking materials and remove all other possible ignition sources from the vicinity. When lights are necessary, use only spark proof electric flashlights. Keep internal combustion engines well away from the vapor cloud. Do not allow trains to pass on adjoining tracks, or vehicular traffic to pass on adjacent roads as long as the LEL detectors show readings at or above the lower explosive limit. Use an LEL detector to determine the boundary of the lower explosive limits of a flammable vapor cloud.
2. Post guards and keep all spectators at least 2500 feet away.
3. Dig holes and trenches, or build earthen dikes in the path of the flowing liquid to reduce the liquid's surface area from which vapors can be given off. The vapor of flammable gas is usually heavier than air and tends to form a layer on the ground. These vapors will flow following the slope of the ground, and will settle in low places and places sheltered from the wind. Vapors will not drift or flow against the wind but may travel a considerable distance with wind. Dispersion of vapors will depend on the wind speed and direction. Vapor dispersion may be aided by using streams of water to break up the vapor at the point of leakage from the car. Water fog will tend to disperse vapors in still air.
4. Do not permit flammable gas to drain into sewers since vapor arising from it may ignite at some point far distant from the leak. Do not permit liquid to drain into water sources. Contaminated water may cause environmental harm.
5. Locate all leaks and stop them if possible.

6. Wrecking operations or transfer of contents of tank cars of flammable gas should not be attempted until all vapors in that vicinity are dispersed. Cutting torches must not be used on tank car tanks, either loaded or empty unless purged.
7. If leaks are expected during the handling of wrecked cars or other vehicles, transfer their contents to another car or container. Transfer of flammable gases should only be performed by trained personnel who are experienced in the necessary techniques.

ASSESSMENT OF TANK DAMAGE Tank cars and other bulk containers involved in accidents may suffer severe damage without an immediate loss of their lading. This damage may look impressive, even awesome, and yet the car or other container may still have sufficient reserve strength to permit it to be carefully removed from the accident site, with its contents, for later transfer or unloading.

The most treacherous damage that can occur to tanks and other containers is that caused by bending, denting, scoring or gouging without resultant leaks. Time, pressure and handling can result in a delayed rupture. If this happens, almost always there will be enough heat caused by the tearing of the metal to ignite the contents of the tank and cause the same kind of fireball described earlier.

It must be noted that flammable gases are usually shipped in tank cars with external jackets. "Tank" damage refers to injuries suffered by the tank itself and not by the outer jacket. The presence of an outer jacket may be detected by observing the car to see if the ripped or torn outer covering reveals insulating material and, beneath that, another layer of metal. Resolve all doubts in the direction of safety and *never* attempt to cut or "jack" away the outer skin to search for an inner tank.

The assessment of tank damage is not a casual matter and requires the presence of trained experts. The guidelines presented here are only intended to allow those first on the scene to make an initial appraisal for purposes of ordering a retreat until expert appraisal advice is available. The Bureau of Explosives, tank car builders and some major shippers of hazardous materials can assist in evaluating damage to tank cars and other bulk containers involved in accidents.

Each dent, score or gouge must be examined. As adjacent cars or surrounding materials are removed, or as the tank itself is moved, the newly exposed surfaces must be examined as well.

Dents in combination with scores, gouges or cracks and dents which cross a weld seam are the most dangerous and the tighter or smaller the radius or curve of the dent, the more dangerous it is. Dents in the cylindrical section of the tank, parallel to the long axis, are usually considered to be more dangerous than large dents in the head, but even large head dents are dangerous if they appear in conjunction with a gouge, score or crack. Small head dents (not exceeding 12" in diameter), especially with tightly bent edges, should be considered marginal and may justify unloading in place, usually by transferring the material to another tank car or other container at the accident scene.

Any crack in the base metal of a tank, especially if in combination with a dent, score or gouge, justifies unloading the tank before it is moved (except as may be necessary to get the valves upright or at least accessible).

Scores or gouges are especially dangerous if they are longitudinal and approach 1/16 inch in depth. (The steel in some cars, and their pressure ratings in relation to the vapor pressure of the product they contain, may allow scores of greater than 1/16 inch without a fatal loss of residual strength, but these distinctions are not important from the point of view of initial emergency response decisions.)

To repeat, the assessment of tank damage is a skill that requires training and the evaluation of not just the damage to the tank itself, but also such factors as outside air temperature, the product in the tank and its vapor pressure and the internal pressure in the tank. In a questionable situation, the best course is to withdraw half a mile, send for expert help and keep the tank cool.

"Keeping the tank cool" does not always mean flooding it with hose streams. In a non-fire situation, a spray or fog may be able to envelop the whole car and keep a film of water on it, allowing both evaporative cooling and cooling by conduction. The cooling effect of water applied to an insulated tank is questionable. However, a tear in the jacket or the destruction of insulation by fire or physical causes may make an insulated tank operatively non-insulated in an emergency situation.

When a fire, especially a "torching" fire, impinges on another tank, a heavy hose steam directed at the point of flame contact may prevent a dangerous heat and pressure build up in the non punctured tank. A "torching" fire occurs when a tank has been punctured and the flammable gas is burning out of the hole in a strongly projecting flame. With this kind of fire, unmanned monitor nozzles provide greater protection for firefighters than hand lines.

Another situation where flooding with water may be inappropriate occurs when the water temperature is higher than the temperature of the product in the tank. This is often the case during the winter months.

It must be remembered that a water attack is almost never the first thing that emergency responders should attempt. The General Rules stated earlier, especially those relating to making an initial survey and obtaining specific product identification and information, should be followed prior to laying, charging and using hose lines.

FLAMMABLE LIQUIDS

GENERAL Flammable liquids have a flash point below 100° F (37.8°C). The flash point of a liquid is the temperature at which that liquid will give off enough vapor for ignition to occur. While the term "flash point" is often misunderstood, it is an important concept to understand because it is the vapor which burns, not the liquid.

The possibility of ignition is greatest for liquids having low flash points. The lower the flash point, the greater the probability that either the temperature of the liquid or the temperature of the surrounding air will be higher than the flash point of the liquid. The higher these temperatures, the greater the amount of vapor formed and, thus, the greater the hazard. Quite frequently, when leakage occurs in the course of a derailment, ignition is caused instantly by friction sparks.

If the vehicle(s) involved in the accident are carrying packages of flammable liquids (in other words, if they are not tank cars or tank trucks), one should assume that the packages are broken and that leakage which could cause a fire has occurred. The presence of vapors will generally be indicated by odors characteristic of the chemical. If it is safe to do so, any vehicle containing packages of flammable liquids should be open for ventilation. The vehicle or packages marked with flammable liquid labels should be carefully removed to a safe place, away from ignition sources. When the leakage is continuous, ventilation will probably not remove the danger. In this case, removal of ignition sources is imperative for the safety of responders.

Flammable liquids spilled from broken packages should be well covered with chemically compatible dry absorbent material, including earth, sand or special sorbents.

Flammable liquids with a low boiling point, such as ethylene oxide, carbon disulfide and diethyl ether, may develop sufficient pressure inside a tank that the criteria for ASSESSMENT OF TANK DAMAGE, discussed earlier under flammable gases, will also be of use in evaluating an accident in which they are involved.

Additional information about these materials will be found in the detailed commodity section which follows. This information should be consulted when assessing the danger of an accident situation involving these materials.

IF ON FIRE In addition to the general emergency response recommendations given earlier, there are other actions or

considerations which may reduce the hazard and aid in containing and extinguishing the fire:

1. Pull away any other cars or vehicles that are movable and not burning.
2. Dig holes or build earthen dikes in the path of the burning liquid vapors to limit and contain the fire area and protect other cars or adjacent property.

3. Smother fires around the car or other vehicle. Sand, dirt, foam and carbon dioxide are good agents. Water from a fog nozzle may smother the fire, but water is likely to float the liquid and may act to spread the fire.

When vapors are burning at the safety valves, do not extinguish the flame unless re-ignition can be prevented. Putting out a fire at a safety valve may allow leakage from the valve to spread and ignite, causing a sudden violent flash fire. It is safer to let the vapor burn at the valves or point of leakage. The fire may be controlled to protect the surrounding area (both other transportation vehicles and surrounding property).

Generally it is a good idea not to extinguish the fire at its source until all spilled material has either been burned or its re-ignition can be prevented.

4. Watch all tanks in the fire for evidence of bulging or the appearance of red-hot spots in the metal. Both are indications that the strength of the steel is being reduced by the heat to a point where it may not be able to hold the pressure in the tank maintained by the safety valves. If these signs are observed, keep all persons away from the tanks; if the metal fails, a stream of burning liquid or vapor may be projected many feet.
5. If sufficient water is available, use it as a fog to cool tanks affected by the heat of the fire. Remember that the run-off from the fog streams may spread the burning liquid.
6. As a general recommendation, do not puncture or rupture the shell of a transport vehicle involved in a fire because any opening made in a tank will liberate more flammable liquid and extend the fire. (There are circumstances in which it may be determined that a deliberate "holing" of the tank is necessary to reduce the time of the exposure or to permit other mitigating actions to take place more quickly. This determination, and its implementation, should only be made by experts. The Bureau of Explosives, tank builders and some major shippers of hazardous materials can assist in these decisions.)
7. The safety valves on tank cars are designed to limit the internal pressure to much less than the bursting pressure of the tank. In order to work, they must not be left open, broken off or buried. If the safety valves are obstructed, try to move the tank car in a position to let the valves function properly.

IF NOT ON FIRE When fire does not occur immediately in a wreck, the hazard of a leak of flammable liquid is generally considered to be greater than when fire is immediately present. The vapors of a flammable liquid will spread over a greater area (and often more rapidly) than the liquid. While the liquid will flow down hill, the vapors travel down wind and may engulf slight high spots that were "safe" only moments before. Vapors cannot be confined and will ignite upon contact with any spark or flame. Vapors will burn with great rapidity, violence, and intense heat back to the liquid surface from which they originated. After such a flash of fire, the vapor will burn above the surface of the liquid.

When the material is not on fire:

1. Extinguish all sources of ignition in the vicinity. When lights are necessary, use only spark proof electric flashlights. Keep internal combustion engines out of the vapor cloud. Use an explosimeter or other detector to determine the boundary of the lower explosive limits (LEL) of a flammable vapor cloud. Keep people and power equipment at least 2500 feet away until the boundary of the LEL is known. Continual monitoring

of the LEL boundary is necessary until the discharge is stopped and the vapors are known to have dispersed.

2. Post guards and keep all spectators over 2500 feet away.
3. Dig holes or trenches or build earthen dikes in the path of flowing liquid to contain the leak. This limits the amount of surface area from which vapors can come.
4. Cover the liquid with sand, dirt, or any other available material which will blanket the surface and reduce the rate of evaporation. The vapor of gasoline and most other flammable liquids is heavier than air and forms a layer along the ground which mixes with the air. This mixing action is increased by wind. These vapors flow along the ground and settle in low places sheltered from the wind. They will not drift or flow against the wind but may travel a considerable distance with it.
5. Vapors can be dispersed by spraying with a water fog. The run off should be checked for flammable concentrations of the liquid. Do not permit the liquid to drain into sewers because vapors arising from the liquid may ignite at some point far distant from the leak and cause serious property damage or personnel injury. The contaminated water may cause environmental harm if allowed to mix with surface or ground water.
6. Attempt to close tank valves and stop all leaks if possible. Wooden plugs are helpful and may be carried in the railroad's wreck train or as part of the equipment of a wreck clearing contractor.
7. Wrecking operations as well as the transfer of the contents of the vehicle should not be attempted until all vapors are dispersed.
8. Cutting torches must not be used on empty or loaded cars as long as detectors show readings above the LEL. When cutting torches are deemed safe to use, avoid contact with either products which have leaked or with ground saturated with such leakage. These materials can be ignited and will burn as do flammable liquids.
9. Many liquids that are regarded as safe under ordinary conditions and transported as combustible or non-regulated materials should be treated as dangerous when handling a wreck. An empty or partially empty tank car, with or without placards, should be regarded as containing a vapor-air mixture which may ignite.
10. Fumes in any empty tank car can injure a person. An empty tank should not be entered without personnel protective equipment adequate for its internal atmosphere until it has been thoroughly cleaned and checked for residual vapors.
11. Move the least damaged cars to safety and avoid sudden shocks or jars that might produce sparks or friction. Do not move a damaged tank car that is leaking flammable liquid. If a tank car with only a small leak *must* be moved a short distance, it may be possible to attach a bucket under the leak to prevent the spread of the flammable liquid.
12. Do not allow trains to pass on adjoining tracks, or vehicular traffic to pass on adjoining roads, as long as the explosimeter shows reading at or above the lower explosive limit.

NONFLAMMABLE GASES

GENERAL Taken as a group, nonflammable gases are materials which do not (readily) burn and which have, in a container, either an absolute pressure exceeding 40 pounds per square inch (psi) at 70°F. or, regardless of the pressure at 70°F., an absolute pressure exceeding 104 psi at 130°F.

The most common nonflammable gases in transportation are anhydrous ammonia and chlorine. Both of these commodities can be deadly. Whenever possible, the shipper should be called

upon to assist in handling accidents in which these commodities are involved.

The transfer of the contents of a car of non-flammable gas should only be done by persons familiar with the risks involved and trained in the proper procedures and precautions.

The criteria discussed in ASSESSMENT OF TANK DAMAGE which appeared above, in the section on flammable gases, are also applicable to most of the tanks used to transport non-flammable gases.

Additional information about these materials will be found in the detailed commodity section which follows. This information should be consulted when assessing the danger of an accident situation involving these materials.

IF FIRE IS PRESENT If the wreckage is on fire, the heat of the fire will tend to vaporize any leakage and may carry the fumes skyward. If the car or container is not leaking, every effort should be made to extinguish the fire or to move the car or container away from the fire.

The tanks of single-unit tank cars authorized for the transportation of nonflammable gases may or may not be insulated. They are equipped with safety valves which are designed to prevent the build up of excess internal pressure.

Gas cylinders, with few exceptions, are provided with safety devices to prevent rupture in case they are exposed to fire. All unauthorized persons should be kept at least 1500 feet away in case the cylinder bursts due to flame or heat impingement. An explosion could throw pieces of the cylinder several hundred yards.

IF FIRE IS NOT PRESENT If there is a leakage of liquid from any container of nonflammable gas, avoid contact with the liquid because it is likely to cause destruction of the skin tissues by freezing. Water spray should be used to knock down the vapors, but the run-off from the spray may have to be collected and/or neutralized to prevent further danger to persons, property and the environment.

Because of the poisonous and irritating nature of most of these gases, all persons in the vicinity of a leak should be kept upwind. All persons in the path of irritating or poisonous fumes should be moved to a safe location. The leaking car or container should, if possible, be moved to a point where the escaping vapor will be carried by the wind away from occupied buildings or locations.

It is difficult to stop compressed gas leaks, except where the gas escapes through an open valve. A leaking cylinder containing ammonia, chlorine, or sulfur dioxide should be moved to an isolated place. Cylinders of compressed gases that are not leaking should be removed from the wreck. Avoid breaking any valves or striking the cylinders.

CORROSIVE MATERIALS

GENERAL Corrosive materials are liquids or solids that cause visible destruction or irreversible alterations in human skin tissue, or, in the case of a leakage from its packaging, a liquid that has a severe corrosion rate on steel.

If corrosive materials come in contact with the body, water should be applied immediately and in large enough quantities to wash the material away. A general rule is to liberally wash the affected area for at least 15 minutes. If this action is taken quickly enough, it is possible to prevent or greatly reduce injury.

Avoid breathing the vapors of corrosive materials. They can cause severe respiratory distress, the onset of which may be delayed by hours or even days.

If the contents of a car of corrosive materials must be transferred, persons familiar with the dangers and techniques should perform the task. A good supply of water should be kept at hand in case of splashes or spills.

Additional information about specific corrosive materials will be found in the detailed commodity section which follows. This information should be consulted when assessing the danger of an incident involving these materials.

IF FIRE IS PRESENT The heat of a fire can accelerate the corrosive action of some of these materials. Some, but not all, corrosive materials are combustible or burnable. Specific fire response recommendations will be found in the detailed commodity section which follows.

IF FIRE IS NOT PRESENT If the leak is small, a bucket can be used to prevent the leak from spreading. The bucket will have to be of a material not attacked by the corrosive involved. Larger spills will require the digging of holes or the building of earthen or sand dikes. Saturated soil may have to be neutralized or otherwise disposed of to prevent long term environmental harm. Factors to consider in the decision for containment are the soil characteristics and the location of water. If the soil is porous or near watersheds or water sources, additional measures—such as lining the containment area and on site soil neutralization—may be necessary.

POISON B MATERIALS

GENERAL These materials are liquids and solids (including pastes and semisolids), other than Class A Poisons or materials classed as "irritating," which are toxic to humans through ingestion (eating), inhalation or absorption. The vapors of some Class B poisons can be dangerous or offensive but to a lesser degree than the gases or liquids requiring the "Poison Gas" label or placard. Some of these poisons are flammable and expert advice from the shipper should be obtained if at all possible.

If poisons come in contact with the body, immediately wash affected areas with water or soap and water. If they can be washed off quickly enough, injury may be prevented. Any person affected by the vapors should be removed from the area and placed on his/her back with head and back elevated. Call a physician immediately and tell the doctor the name of the poison involved. If clothing is saturated with poison, remove it to prevent further poisoning. Keep patient warm and quiet. If breathing has apparently ceased, start resuscitation immediately but remember that mouth-to-mouth artificial respiration may expose the rescuer to fumes inhaled by the victim.

Personnel should be evacuated from the area known or suspected to be contaminated by the materials or their vapors. Whenever possible, monitoring equipment should be used to aid in determining and evaluating the contaminated area.

Protective clothing should be worn by personnel dealing with the incident, and should be decontaminated after exposure.

Vehicles which contained any poisonous materials must be thoroughly cleaned after unloading or before going back into service.

Additional information about these materials will be found in the detailed commodity section which follows. This information should be consulted when assessing the danger of an accident situation involving these materials.

IF FIRE IS PRESENT Fires may be fought using conventional means, but all personnel in the area should have protective gear appropriate for the material(s) involved. Because the run-off may be contaminated, precautions should be taken to contain and reduce the area affected by the run-off. The methods usually available, such as digging holes or building earthen dikes, are often effective. However, any countermeasure should be evaluated to reduce not only the short term problem but also to reduce the potential post-accident cleanup costs and long term environmental degradation.

IF FIRE IS NOT PRESENT If any container of these materials is leaking, no person should be allowed to enter the contaminated area without appropriate breathing apparatus and other protective equipment suitable for the material. If qualified persons are available, attempts to plug the leak or reduce the amount of leakage by use of wooden plugs may be made.

Smaller containers, such as drums, can often be prevented from leaking by positioning the container so that the leak is above

the level of the product. With tank cars or tank trucks, this may be possible if heavy equipment and operators trained in the necessary techniques are available. Rolling tank cars or trucks is a specialized "art" and not every operator of heavy equipment has the necessary skill. The Bureau of Explosives can assist in evaluating the procedures to be used. Every precaution must be taken to keep leaking liquid from contacting the skin. At least two persons should work together. The second person should be available to help the first in case of an emergency.

Digging holes or building earthen dikes to prevent any leakage from spreading is usually effective, but the effects of this action on post-accident cleanup and long-term environmental problems should be considered. Decontamination procedures will depend on the material involved. The agencies listed in the general recommendations section, earlier, may be able to provide help.

If it is necessary to transfer the contents of any containers of these materials, persons skilled in those operations should perform the task. The shipper, nearest manufacturer or the Bureau of Explosives may be able to provide the necessary assistance. When handling or transferring these materials, appropriate protective equipment must be utilized.

FLAMMABLE SOLIDS

GENERAL There are only two major materials classed as flammable solids which are shipped in tank cars: phosphorus and sodium.

Phosphorus will ignite with air at or above 86°F. It is explosive when mixed with oxidizing materials. Phosphorus tank cars in a derailment are likely to have a ruptured disc. Cars with a ruptured disc should be filled with water and the disc should be replaced.

Phosphorus on the outside of the car should be scraped off (after it stops burning) and disposed of in an appropriate facility. Scraping may expose unburned phosphorus which will burn if not kept under water. Protective clothing is required because phosphorus burns are very painful. Inhaling small amounts of phosphorus can be fatal.

A leaking phosphorus car will burn until it crusts over. This fire should be fought with dirt or sand (preferably wet) and the phosphorus should be contained as near the car as possible. Once the fire is out, the car can be moved under water fog to clear the right of way.

A dike should be built to prevent further fires. Spilled phosphorus can be temporarily buried under a mud cap until wrecking operations are completed. The residue from burned phosphorus is phosphorus pentoxide, a corrosive material which will dissolve in water to form phosphoric acid, another corrosive material. Final disposal of the car and the remaining product and residues will have to be coordinated with an appropriate environmental protection agency (usually Federal and/or state) and with the shipper or consignee.

Sodium is a water reactive flammable solid. **DO NOT USE WATER ON SODIUM.** If a sodium car leaks, use dry soda ash, dry earth, salt, lime, powdered limestone, or any dry inert substance. **DO NOT USE WATER, CARBON DIOXIDE, CARBON TETRACHLORIDE, FOAM, OR ANY OTHER LIQUID FIRE EXTINGUISHING AGENTS INCLUDING FREONS,** because they will either cause a fire or will react violently with sodium. Burning sodium releases sodium oxide fumes which will react with water to produce sodium oxide fumes which will react with water to produce sodium hydroxide (caustic soda) which is injurious to eyes, skin, and mucous membranes.

Other commonly shipped flammable solids include "strike anywhere" matches and charcoal. Naturally, they are not shipped in tank cars, although under certain conditions the DOT regulations permit charcoal to be shipped in bulk.

Fire in shipments of "strike anywhere" matches is frequently caused by the ignition of the match heads in one or more of the inner cartons. If the outer box is not broken or opened, the fire is

generally confined to these cartons, and after the head composition of the matches is consumed, the fire goes out. If the outside box is not broken, and the smoke dies away after a few minutes, no further action is necessary, because the fire has already been extinguished from a lack of air, and nothing will be gained by opening the box. If the fire has gained some headway, the burning box or boxes should be removed, if possible, or water should be freely used. Boxes should not be broken open any more than necessary because this will only add more fuel and may add to the fire.

When charcoal is on fire during transit, water should not be used if it is practicable to locate and remove the material on fire. This is because wet charcoal is much more liable to ignite spontaneously, and the fire cannot be stopped permanently except by the use of copious amounts of water.

Fires in ground charcoal or in charcoal screenings are best handled by removing the burning packages. If this is not practical, water should be used sparingly to extinguish the visible fire, then remove all the charcoal and separate the wet from the dry material. The wet charcoal must be destroyed. The dry charcoal should be stored under cover in a dry place, and held under observation for at least five days before further shipment, in order to reduce the chance of another ignition.

Additional information about these materials will be found in the detailed commodity section which follows. This information should be consulted when assessing the danger of an accident situation involving these materials.

OXIDIZERS

GENERAL A few oxidizers are shipped in tank cars and most of them will cause fire in contact with combustible materials. Nitric acid, mixed acid, perchloric acid, or hydrogen peroxide are examples of oxidizers shipped in bulk quantities by rail. All of these may cause fire when brought into contact with combustible materials.

In accidents involving chlorates, care is necessary to prevent ignition by friction or by contact with acids. When chlorates are mixed with organic matter, or even with dust, they form very flammable mixtures. Chlorates in contact with sulfuric acid are liable to cause fire or explosion.

Solid oxidizers that are mixed with finely divided combustible material may burn with almost explosive violence.

If it is necessary to transfer the contents of a car of these materials, persons familiar with the dangers and techniques should perform the task.

Additional information about these materials will be found in the detailed commodity section which follows. This information should be consulted when assessing the danger of an accident situation involving these materials.

IF FIRE IS PRESENT For liquid oxidizers, water should be used in sufficient quantity to extinguish the fire and to dilute and wash away the liquid. (Remember that the run-off may also be hazardous. Contaminated water should be contained for treatment or disposal.) Whenever water contacts acids, splattering and slight explosions will occur; thus, a stream of water should be applied to the fire from a safe distance. (A good "safe distance" in this case is maximum distance that water from hose streams can be applied effectively.) The reddish fumes caused by fires of nitric acid or mixed acids are irritating and poisonous. Do not expose personnel to such fumes unless they are equipped with self contained breathing apparatus and full protective clothing—the fumes can cause skin damage.

When solid oxidizers, such as sodium nitrate and other nitrates that ordinarily will not burn, are mixed with organic matter during the course of an accident or its cleanup, they will burn strongly if ignited. The heat of burning melts the nitrate which will then ignite any combustible material it touches. Melted nitrate holds a great deal of heat and when water is thrown on it, the sudden generation of steam will cause the melted nitrate to

spatter and start a fresh fire. Whenever practical, fires in nitrate shipments should be smothered with earth or sand. Water should only be used when the fire is small. For the reasons stated above, the use of water on large fires of solid oxidizers is seldom effective.

IF FIRE IS NOT PRESENT Position personnel upwind from the spill or leak. Because these materials can react with combustible materials, such as leaves and twigs, to cause fires, digging holes or the building of earthen dikes may not be effective. Containing the material in an area cleared of combustible material may help to reduce the hazard.

ORGANIC PEROXIDES

GENERAL These materials may be either liquids or solids. They support the burning of combustible materials. Under prolonged exposure to fire or heat, containers of these materials may explode.

Liquid organic peroxides take some effort to ignite but once ignited, they burn with increasing rapidity as the fire progresses. If spilled on combustible materials, spontaneous ignition of the material may occur. Contamination of organic peroxides with a wide variety of chemical substances can cause a violent chemical reaction, therefore, care must be taken during the response effort to consider material compatibility.

Solid organic peroxides are more readily ignited and burn with increasing rapidity as the fire progresses. If mixed with finely divided combustible materials, explosive mixtures may be formed.

Some organic peroxides are shipped under refrigeration. If the refrigeration fails, the product may decompose and give off sufficient heat to start a fire. The driver of a vehicle containing refrigerated organic peroxides is usually highly trained in the properties and handling of the material and has additional technical information on the material in the shipment.

Additional information about these materials will be found in the detailed commodity section which follows. This information should be consulted when assessing the danger of an accident situation involving these materials.

POISON GASES

GENERAL The fumes from poison gases are deadly. Inhalation or contact with the vapors can be fatal and should be avoided. Often poison gas leakage is not noticeable because it cannot be seen or smelled. Use extreme care when handling any container of these gases. The shipper or the nearest manufacturer of the gas should be called for assistance in any incident involving leakage.

Poison gases are transported in single unit tank cars, in cylinders and in multi-unit tank cars. The multi-unit tank car looks like a flat car with a series of cylinders carried on their sides, arranged so that the ends of the "cylinders" (actually DOT Specification 106 or 110 tanks) point towards the sides of the car. The "tanks" or multi-unit tank cars, which may also be transported on trucks or trailers, are detachable, are not insulated and, when used for the movement of poison gases, are not equipped with safety relief devices.

Additional information about these materials will be found in the detailed commodity section which follows. This information should be consulted when assessing the danger of an accident situation involving these materials.

IF FIRE IS PRESENT Because they are not equipped with safety devices, cylinders or multi-unit tanks are liable to burst or rupture when involved in a fire or when subjected to prolonged intense heat. Evacuate the area if the fire cannot be brought under immediate control to protect persons from cylinder fragments and from fumes should an explosion or a rupture occur. If poison gas tanks are not leaking but are endangered by fire,

every effort should be made to extinguish the fire around them or to move the tanks away from the fire.

If the tanks are leaking, the fire may tend to vaporize the leakage and carry its fumes skyward. Do not rely on this to happen.

In clearing a wreck involving these tanks, cutting torches should only be used with extreme caution and then only by persons well trained in their use and familiar with the dangers involved.

IF FIRE IS NOT PRESENT If there is leakage of liquid or gas from a tank or cylinder containing poison gases, keep all persons out of any area where the vapors may accumulate. Detectors for the presence of these fumes are available, but are often so product specific that they may not be readily available. Personnel in the area should be limited to those absolutely essential to make a survey of the danger present. Immediate assistance should be secured from the shipper or consignee.

No person should be allowed to enter the gas contaminated area without being equipped with a self-contained breathing apparatus and fully protective clothing. Persons using such apparatus must be qualified and experienced in its use. Cooling the tank with streams of water may be effective in reducing the internal pressure and rate of leakage. If it is possible to roll the tank so the point of leakage is at the top, the hazard may be reduced considerably. At least two persons should work together, with the second holding him/herself in position to be of assistance to the first in case of emergency.

Any person affected by the gas should be removed from the contaminated area and placed on his/her back with head and back elevated. Call a physician immediately and tell the doctor the poison to which the victim has been exposed. If clothing is saturated with the gas, remove it to prevent skin irritation and burns. Keep the patient warm and quiet. If breathing has apparently ceased, start resuscitation immediately, but remember that mouth-to-mouth artificial respiration may expose the rescuer to fumes inhaled by the victim.

RADIOACTIVE MATERIALS

GENERAL These materials emit certain rays that may be hazardous. These rays can be detected only by instruments. Exposure of humans to intense radiation may be harmful, whereas films may be damaged by radiation of relatively low concentrations. The long term exposure of humans to relatively low levels of radiation may also be hazardous over time, but this is not usually a relevant consideration at an accident site where exposures are likely to be brief.

Additional information about these materials will be found in the detailed commodity section which follows. This information should be consulted when assessing the danger of an accident situation involving these materials.

GENERAL INSTRUCTIONS:

1. Until the extent of the hazard can be determined, keep all persons the greatest practicable distance away.
2. Trains and vehicles may pass if they can do so without stopping in the suspected area and without scattering spilled material.
3. Except for Low Specific Activity materials, PERSONS NOT PROPERLY PROTECTED AGAINST RADIATION MUST NOT BE PERMITTED TO APPROACH THE VICINITY OF ANY PLACE WHERE RADIOACTIVE MATERIAL IS SUSPECTED TO HAVE BEEN SPILLED. Protection of personnel will vary, depending on circumstances and may consist solely of radiation monitoring. In cases where radioactive material has been scattered, anticontamination clothing and a means of shielding personnel from radiation may be necessary.
4. If material is involved in fire or spillage, avoid exposure to smoke fumes or dust.

5. Take precautions to avoid further spreading of spilled materials.

If radioactive material is submerged as a result of the accident, all persons must be kept as far away from the area as is practicable until qualified persons are available to direct the removal of the submerged material.

6. Assistance in handling and arranging for the disposal of radioactive materials can be obtained from the appropriate Department of Energy Regional Coordinating Office or from the 24 hour emergency number of the Nuclear Regulatory Commission. (See map and listing below.)

DETAILED PROCEDURE If there is evidence of any damage to a shipping container, determine, with proper instruments, whether the outside container has been broken open and whether material has been actually exposed or spilled. If the container is damaged, it is generally recommended to proceed as follows, depending on the type of package involved.

FOR SMALL PACKAGES (Fiberboard or wooden boxes or steel or fiber drums weighing less than 200 pounds.):

1. Keep all persons at least 10 feet away if practicable and do not remain near exposed material unnecessarily.
2. If it is impractical to keep persons away, sandbag or cover the radioactive material with at least 4 inches of earth or sand, using a long-handled shovel. Remain near the material only as long as is necessary to accomplish the work.
3. Contact the DOE or NRC telephone number, below, for assistance in arranging for the removal of the material and any necessary decontamination.

FOR PACKAGES OF HEAVY STEEL OR METAL CONSTRUCTION (weighing 200 pounds or more and lined or partially filled with lead, concrete, or paraffin.):

1. If there is any evidence that the container has been broken open or is seriously damaged, observe the recommendations in the GENERAL INSTRUCTIONS until assistance or further advice has been obtained from a competent authority.
2. Even though a container has not been opened or damaged, persons should not remain near container unnecessarily until it has been determined that no radiation hazard exists.

LOW SPECIFIC ACTIVITY (LSA) materials, such as uranium and thorium ores, waste paper or other contaminated scrap materials, are packed in ordinary containers such as bags, steel

or fiber drums, or wooden or fiber boxes and may be in the form of powders, liquids or sludges.

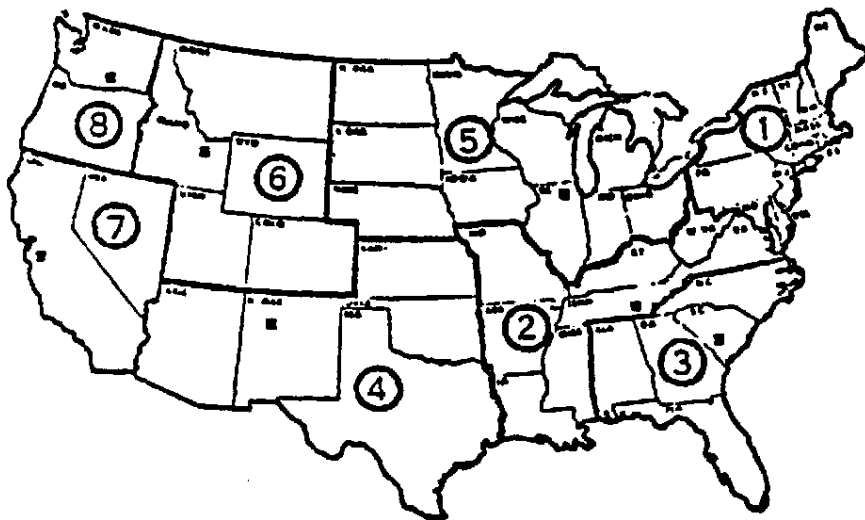
1. Obtain assistance of qualified persons to handle spilled materials. Use the appropriate DOE or NRC telephone number listed below.
2. Avoid direct contact with spilled materials.
3. Protect persons from breathing any dust which may be around these materials. This can be accomplished by approaching from the upwind side or by breathing through respirators or handkerchiefs when other means are not available.
4. Prevent the spread of spilled material and keep it out of streams, reservoirs, or other bodies of water.

FOR DEPARTMENT OF ENERGY—DEPARTMENT OF DEFENSE ESCORTED SHIPMENTS (sometimes shipped as explosive and radioactive material):

1. If guards are present and not incapacitated, follow their recommendations with regard to safety and mitigation of hazards until other assistance arrives.
2. If the guards are incapacitated and the shipment is involved in a fire which cannot be readily brought under control, keep all persons at least a mile away and observe the recommendations in the GENERAL INSTRUCTIONS.
3. If the guards are incapacitated and the shipment is not involved in fire, it should not be moved until proper instructions for its disposition are received from the shipper or the Department of Energy.
4. In addition to the report to National Response Center required in the General Rules, immediately report the accident by telephone to the Albuquerque Operations Office of the Department of Energy, Albuquerque, New Mexico, (505) 844-4667.

For assistance from the Department of Energy Regional Coordinating Office, nearest you please consult the map below and call the office in the region in which assistance is requested. For military shipments (Department of Energy—Department of Defense escorted shipments) contact the Albuquerque Operations Office of the Department of Energy at (505) 844-4667.

For assistance from the Nuclear Regulatory Commission, call (301) 492-8111. This number can be reached on a 24-hour basis.



DOE Regional Offices

Brookhaven

1—(516) 345-2200

Oak Ridge

2—(615) 576-6833

or (615) 525-7885

Savannah River

3—(803) 824-6331, Ex. 3333

Albuquerque

4—(505) 844-4667

Chicago

5—(312) 972-5731

or (312) 972-4800

Idaho

6—(208) 526-1515

San Francisco

7—(415) 273-4237

Richland

8—(509) 942-7381

EXPLOSIVES

GENERAL Explosives are chemical compounds, mixtures, or devices, the primary or common purpose of which is to function by explosion. These materials are divided into 3 classes:

Class A explosives will detonate.

Class B explosives function in general by rapid combustion rather than detonation. A fire, once initiated in these materials, is virtually impossible to extinguish until the material has been consumed.

Class C explosives may contain either Class A or B explosives, but in restricted quantities. Small arms ammunition, explosive rivets and common fireworks are examples of this class of explosives.

If an accident involving these materials results in an explosion, about the only thing that can be done is to care for any injured, and to prevent the spread of any fire which may have been caused by the explosion.

When these materials are involved in accidents, it is essential to establish early contact with the Bureau of Explosives and the shipper.

For shipments of explosives made by the Department of Defense that are found in distress, contact the telephone number provided on the government bill of lading for notification/assistance.

Additional information about these materials will be found in the detailed commodity section which follows. This information should be consulted when assessing the danger of an accident situation involving these materials.

IF FIRE IS PRESENT If a fire has started near explosives, every effort should be made to put out the fire, or to remove the explosives to a safer place. Some explosives detonate immediately on ignition, others may burn for some time before exploding, and others may be completely consumed without any explosion. However, since burning explosives must be presumed to detonate easily, efforts to extinguish them are not recommended. Applying water to burning explosives may precipitate an explosion through the action of the steam that is generated.

In all cases where explosives are involved in fires or serious accidents on the railroad, the Bureau of Explosives should be notified. The Bureau of Explosives' representative may be able to assist in determining whether the explosive involved may have contaminated the area. If so, necessary procedures for decontamination may be organized.

The recommended evacuation distances for explosives are:

Class A explosives	1 mile
Class B explosives	1/2 mile
Class C explosives	1500 feet.

IF FIRE IS NOT PRESENT If the accident does not cause the immediate ignition or detonation of the explosives, the first and most important precaution is to prevent fire.

The area should be guarded to keep all unauthorized persons away. Because of the potential hazard, it cannot be emphasized strongly enough that access to the accident site should be limited to only those experts necessary to make an initial assessment. All other response personnel should remain beyond the recommended evacuation distances.

Before beginning to clear a wreck containing explosives, remove all unbroken packages to a place of safety and gather any remaining explosive material rendered inert. Many explosives are readily set off by a direct blow or by the spark produced when two pieces of metal or a piece of metal and stone come together. In clearing a wreck, therefore, care must be taken not to start a fire with metal tools. With most explosives, a thorough wetting with water usually removes the danger of explosion from spark or impact but with the various kinds of dynamite, wetting does not make them safe from impacts.

After clearing a wreck involving initiating explosives such as fulminates or azides, the ground should be kept wet until expert decontamination help has arrived and proper final cleanup procedures can be carried out.

If the wreck involves a vehicle containing chemical ammunition, every precaution must be taken to prevent fire and casualties due to gas leakage. Only those persons necessary to clear the wreckage should be allowed in the vicinity of the wreck, and they should be cautioned to keep upwind.

If a shipment of propellant explosives, Class B, is involved, it will bear "Explosives B" placards. All packages in the vehicle will be marked to indicate that they contain propellant explosives. Such explosives may be in the form of very fine grains or extremely large solid pieces weighing several tons. Class B Explosives are not liable to explode from impact or friction, although ignition of such explosives by friction is possible. Care must be exercised while handling broken or damaged packages. Every precaution must be taken to keep Class B Explosives away from sparks or flames since many of these explosives will burn rapidly or explode when ignited. Care must be exercised to avoid unnecessary inhalation of smoke since the products of combustion of a few kinds of propellant explosives may be poisonous.

While handling packages of explosives and transferring them to and from vehicles, the greatest care must be taken, because shocks or falls can injure the containers. The shoes of the people handling the packages must be as free as possible from grit, and all possible precautions must be taken against fire.

A broken box of high explosives that cannot be repackaged should be held until the arrival of an authorized person who can supervise the destruction of the condemned material.

Since particles of explosive composition from damaged containers may be strewn on vehicle floors or freight, care should be exercised to avoid friction or sparks from shoes, tools, or other sources. Use of metal trucks, metal hammers or other metal tools should be avoided. Vehicle floors should be thoroughly swept, and washed with a plentiful supply of water. The wash water should be contained for proper disposal.

Packages of leaking liquid explosives must be disposed of carefully. Leaking packages must:

- * be packed in other boxes large enough to permit enclosure,
- * be surrounded by at least 2 inches of dry, fine sawdust or dry and clean cotton waste; and
- * be stored in a safe place until arrival of an authorized person to supervise the destruction of the condemned materials.

Whenever a vehicle carrying explosives has received rough treatment, inspection of the packages containing explosives must be made (without unnecessarily disturbing the lading) to see that they are properly loaded and secured and are in good condition. Leaking or broken packages must be carefully removed to a safe place. Loose powder or other explosives must be swept up and carefully removed. If the floor is wet with nitroglycerin, the vehicle is unsafe to use. The shipper should be contacted and, if the accident occurs on a railroad, a representative of the Bureau of Explosives should be called immediately to supervise the thorough mopping and washing of the floor with a warm, saturated solution of concentrated lye or sodium carbonate. If necessary, the vehicle must be moved to an isolated area and the shipper should be notified.

BLASTING AGENTS

GENERAL Blasting agents are chemical compounds, mixtures, or devices, the primary or common purpose of which is to function by explosion. These materials are used (primarily) in the mining and agricultural industries for blasting. These materials cannot be detonated with an electric blasting cap and will not explode when subject to friction or impact. When the largest single package used for shipping is subject to fire, it will not

explode, however, fires involving more than one package may explode.

If an accident involving these materials results in an explosion, about the only thing that can be done is to care for any injured, and to prevent the spread of any fire which may have been caused by the explosion.

When these materials are involved in accidents, it is essential to establish early contact with the Bureau of Explosives and the shipper.

For shipments of blasting agents made by the Department of Defense that are found in distress, contact the telephone number provided on the government bill of lading for notification/assistance.

Additional information about these materials will be found in the detailed commodity section which follows. This information should be consulted in assessing the danger of an accident situation involving these materials.

IF FIRE IS PRESENT If a fire has started near blasting agents, every effort should be made to put out the fire, or to remove the blasting agents to a safer place. Some blasting agents may burn for some time before exploding, and others may be completely consumed without any explosion. However, since burning blasting agents must be presumed to explode easily, efforts to extinguish them are not recommended. Applying water to burning blasting agents may precipitate an explosion through the action of the steam that is generated.

In all cases where blasting agents are involved in fires or serious accidents on the railroad, the Bureau of Explosives should be notified. The Bureau of Explosives' representative may be able to assist in determining whether the explosive involved may have contaminated the area. If so, necessary procedures for decontamination may be organized.

The recommended evacuation distance for Blasting Agents is 2500 feet.

IF FIRE IS NOT PRESENT If the accident does not cause the immediate ignition of the blasting agents, the first and most important precaution is to prevent fire.

The area should be guarded to keep all unauthorized persons away. Because of the potential hazard, it cannot be emphasized strongly enough that access to the accident site should be limited to only those experts necessary to make an initial assessment. All other response personnel should remain beyond the recommended evacuation distances.

Before beginning to clear a wreck containing blasting agents, remove all unbroken packages to a place of safety and gather any remaining blasting agents rendered inert. Many blasting agents are readily ignited by a direct blow or by the spark produced when two pieces of metal or a piece of metal and stone come together. In clearing a wreck, therefore, care must be taken not to start a fire with metal tools. As with most explosives, a thorough wetting with water usually removes the danger or ignition from spark or impact.

Care must be exercised to avoid unnecessary inhalation of smoke since the products of combustion of a few kinds of blasting agents may be poisonous.

While handling packages of blasting agents and transferring them to and from vehicles, the greatest care must be taken, because shocks or falls can injure the containers. The shoes of the people handling the packages must be as free as possible from grit, and all possible precautions must be taken against fire.

A broken box of blasting agents that cannot be repackaged should be held until the arrival of an authorized person who can supervise the destruction of the condemned material.

Since particles of blasting agents from damaged containers may be strewn on vehicle floors or freight, care should be exercised to avoid friction or sparks from shoes, tools, or other sources. Use of metal trucks, metal hammers or other metal tools should be avoided. Vehicle floors should be thoroughly swept, and washed with a plentiful supply of water. The wash water should be contained for proper disposal.

Packages of leaking liquid blasting agents must be disposed of carefully. Leaking packages must:

- be packed in other boxes large enough to permit enclosure,

- be surrounded by at least 2 inches of dry, fine sawdust or dry and clean cotton waste, and;

- be stored in a safe place until arrival of an authorized person to supervise the destruction of the condemned materials.

Whenever a vehicle carrying blasting agents has received rough treatment, inspection of the packages containing blasting agents must be made (without unnecessarily disturbing the lading) to see that they are properly loaded and secured and are in good condition. Leaking or broken packages must be carefully removed to a safe place. Loose material must be swept up and carefully removed.

IRRITATING MATERIALS

GENERAL Materials in this classification are such that a person will not remain in an area contaminated by them unless escape is impossible. Upon contact with fire or exposure to air, these liquid or solid materials give off intensely irritating fumes. Those which are shipped as liquids or gases might delay the clearance of wreckage if they leak, but otherwise they are not particularly hazardous.

To move leaking or broken packages, they may be approached with safety from the windward side provided there is a breeze brisk enough to carry away the fumes and the broken or leaking package is not in a confined place. The use of self contained breathing apparatus and appropriate protective gear will reduce the chance of noxious contact.

Additional information about these materials will be found in the detailed commodity section which follows. This information should be consulted when assessing the danger of an accident situation involving these materials.

ETIOLOGIC AGENTS

GENERAL An "etiologic agent" means a viable microorganism, or its toxin, which causes or may cause human disease. Whenever packages bearing the "Etiologic Agents" label are discovered leaking in transit, all unnecessary movement of the vehicle must cease and the vehicle must be isolated. Contact with the material must be avoided.

Immediately notify the Director, Center for Disease Control, Atlanta, Georgia (404) 633-5313, for information on handling the incident.

OTHER REGULATED MATERIALS (ORM)

GENERAL These materials are regulated because they may pose an unreasonable risk to health and safety or property when transported, but they do not meet the definitions of the other hazard classes in the DOT hazardous materials regulations. Other Regulated Materials are subdivided as follows:

ORM-A materials have an anesthetic, irritating, noxious, toxic or other similar property and, in the event of a leakage during transportation, they can cause extreme annoyance or discomfort to the passengers and crew of transport vehicles.

ORM-B materials are those which could cause damage to a transport vehicle or vessel from leakage during transportation. Basically, the danger from these materials is their corrosivity to aluminum and the subsequent danger they could pose for aircraft.

ORM-C materials are those which are unsuitable for transport unless properly identified and prepared. All commodities in this group are specifically named in the DOT regula-

tions and almost all of them are regulated only for transportation by water.

ORM-D materials are consumer commodities in packages like those found on store shelves. They present a minimal hazard during transportation because of the form, quantity or packaging in which they move.

ORM-E materials are those not included in any other hazard classification but which are either Hazardous Wastes or Hazardous Substances as defined by the Environmental Protection Agency.

Additional information about these materials will be found in the detailed commodity section which follows. This information should be consulted when assessing the danger of an accident situation involving these materials.

AN EXPLANATION OF TERMS USED FOR EMERGENCY RESPONDERS

The emergency response recommendations given for the hazardous materials in the second section of this book use specific terms with specific meanings. Virtually all of these terms are self explanatory to trained emergency responders, but, as an aid to training and to avoid the danger of confusion, further information about many of the terms is given below. The terms will be grouped and presented in the order in which they appear in section two.

FIRE Responses:

"Use water in flooding quantities as fog"—Flooding quantities are amounts of water which will engulf the object against which they are directed. The water should be applied with a fog nozzle.

"Solid streams of water may be ineffective"—Solid streams of water will not provide the cooling or vapor dispersing effect that a fog will. Water applied in a solid stream will sink through a pool of chemical and will have little or no effect.

"Apply water from as far a distance as possible"—Water should be applied from as far away as the hose stream will reach. Unmanned monitor nozzles are a good option if the stream can be controlled to be effective.

"Suitable" (as in "Use suitable dry powder" or "Extinguish fires using agent suitable for type of fire")—The properties of the burning material must be known and the proper agent employed to apply to it. At the very least, this requires that the product(s) involved in the fire be known.

"Do not use water on material itself"—The material will react with water producing noxious products. The application of water will also promote vaporization of the material due to the heat of reaction with water.

"Use water spray to absorb vapors"—Apply a water fog downwind of a leak, through the vapor cloud taking care to keep water out of the container and, if present, a pool of the product on the ground.

"Do not apply water to point of leak in tank car or container"—Water will react with the product to produce a material that will markedly increase the rate of corrosion or erosion about the hole.

"Water spray or foam may be ineffective"—The size of the probable fire or the reaction between the commodity and water or foam is such that other extinguishing agents will give a better performance.

"Low order explosive potential"—A "low order explosion" has been described as one that goes "wump" or "woosh" instead of "bang."

NON-FIRE Responses:

"Use water spray to knock down vapors"—Direct a water fog or spray, rather than a solid stream downwind into the vapor cloud.

"Use water spray to disperse vapors and dilute standing pools of liquid"—This is basically the same advice as given just above with the added consideration of the dilution of the spilled product.

"Do not use water on material itself"—As noted above under the fire responses, water will have an adverse reaction with the material.

"Do not apply water to the point of leak in tank car or container"—Also as noted above in the fire response section, application of water to the point of leak will cause a reaction between the material and the water which will increase the size of the hole.

PERSONNEL Responses:

Several of the recommendations in this section use the term "protective," as in "protective gloves" and "protective clothing." Obtaining protection from a hazardous commodity requires at least knowing the name of the commodity and understanding its hazardous properties. Shippers and manufacturers of chemicals, suppliers of safety equipment, NIOSH (the National Institute of Occupational Safety and Health), OSHA (the Occupational Safety and Health Administration), NFPA (the National Fire Protection Association), CHEMTREC, the Bureau of Explosives and standard chemical reference works can provide guidance about the suitability of various types of protective equipment with specific chemicals.

Explanations of other terms used in this portion include:

"Wear full protective clothing"—Full protection from a hazardous material requires knowing what the material is and wearing suitable protective equipment which will not be penetrated, eaten away or destroyed. If called for on materials with large leaks, full "acid suit" type gear is required. In most cases where this recommendation is given, traditional fireman's turn out gear is NOT "full protective clothing."

"Avoid bodily contact with the material"—This recommendation applies to commodities with a lower personnel hazard potential than those for which "full protective clothing" is applicable. It is not to be taken lightly and requires knowledge of the material and its dangers. As a practical matter, specialized gear *other than* fireman's turn out gear may be required.

"Wear self contained breathing apparatus"—For many chemicals, pressure demand breathing apparatus is not adequate and a positive pressure system must be used to prevent fumes from entering the mask during inhalation.

"Do not handle broken packages without protective equipment"—While packages which are still tight do not pose a special danger, the material which may have escaped from a broken package does require suitable protective measures.

"Wear self contained breathing apparatus when fighting fires of this material"—The fumes given off by combustion of the material require respiratory protection.

"If contact with the material anticipated, wear full protective clothing"—One can be near the commodity without suffering harm, but contact with it is dangerous.

"Wear boots, protective gloves and gas tight goggles"—In addition to the precautions already noted, this material is harmful or very irritating to the eyes.

EVACUATION Responses:

These responses typically mention an evacuation radius. In all cases, these are minimum distances and do not take into account particular local situations or exposures.

Where an evacuation distance is mentioned in relation to fire involving a container (for example: "If fire is prolonged and material is confined in the container . . ."), it is based on the distances which fragments have been thrown from rupturing containers of the particular product.

Where an evacuation distance is mentioned in relation to a leak without fire and the commodity is nonflammable (for example, "If material leaking (not on fire) evacuate for a radius of 2500 feet."), it is based on the noxious or toxic properties of the material and the minimum potential radius of a cloud of its fumes. In the case of a flammable material, it is based on the potential that a cloud of the material will ignite and burn rapidly back to the source of the leak.

Where an evacuation distance is mentioned such as "If the material is on fire or involved in fire evacuate for a radius of 5000 feet," the effects of fire on the material can be so disastrous that no attempt should be made to fight the fire.

Responses such as "If fire becomes uncontrollable—evacuate . . ." mean that small fires involving the material may be

fought but that large, uncontrollable fires either are impossible to extinguish or may result in a violent rupture of the container.

If during the preparation of a training program using this book, additional questions arise about the selection or meaning of the recommended responses, additional help is available from the Bureau of Explosives by contacting:

Patrick J. Student
Manager—Operations Analysis
Bureau of Explosives
Association of American Railroads
1920 L Street, NW
Washington, DC 20036
(202) 293-4048

**INTERGOVERNMENTAL MARITIME
CONSULTIVE ORGANIZATION
HAZARD CLASSES**

Class Number	Class Name
1	Explosives
2	Gases
3	Flammable and Combustible Liquids
4	Flammable Solids
5	Oxidizers and Organic Peroxides
6	Poisons
7	Radioactive Materials
8	Corrosives

The IMCO classifications are further divided, by adding decimal numbers following the basic classes, into divisions. For instance IMCO class 2 (gases) is divided:

Class 2	Gases
Division 2.1	Flammable gases
Division 2.2	Nonflammable gases
Division 2.3	Poison gases

**COMMODITY SPECIFIC EMERGENCY
RESPONSE AND ENVIRONMENTAL
CONTAINMENT INFORMATION**

**BUREAU OF EXPLOSIVES
Association of American Railroads
1920 L Street, Washington, D.C. 20036**

**Telephone: 202-293-4048
(This number may be reached at all times)**

**ACCUMULATOR, PRESSURIZED
NONFLAMMABLE GAS**

**4904825
NA1956**

Accumulators, pressurized are devices containing a nonflammable gas under pressure.

If material involved in fire

Extinguish fire using agent suitable for type of surrounding fire (Material itself does not burn or burns with difficulty.)

Cool all affected containers with flooding quantities of water

Apply water from as far a distance as possible

Personnel protection

Avoid breathing vapors

Wear protective gloves and goggles

Do not handle broken packages without protective equipment

**ACETAL
FLAMMABLE LIQUID**

**4908103
UN1088**

Acetal is a clear colorless liquid with a pleasant odor. It has a flash point of -5 deg. F. It is lighter than water and slightly soluble in water. Its vapors are heavier than air.

If material on fire or involved in fire

Do not extinguish fire unless flow can be stopped

Use water in flooding quantities as fog

Solid streams of water may spread fire

Cool all affected containers with flooding quantities of water

Apply water from as far a distance as possible

Use "alcohol" foam, carbon dioxide or dry chemical

If material not on fire and not involved in fire

Keep sparks, flames, and other sources of ignition away

Keep material out of water sources and sewers

Build dikes to contain flow as necessary

Attempt to stop leak if without hazard

Use water spray to disperse vapors and dilute standing pools of liquid

Personnel protection

Avoid breathing vapors

Keep upwind

Wear boots, protective gloves, and goggles

Do not handle broken packages without protective equipment

Wash away any material which may have contacted the body with copious amounts of water or soap and water

Evacuation

If fire becomes uncontrollable or container is exposed to direct flame—evacuate for a radius of 1500 feet

If material leaking (not on fire), downwind evacuation must be considered

**ACETALDEHYDE
FLAMMABLE LIQUID
POLYMERIZABLE
ENVIRONMENTALLY HAZARDOUS SUBSTANCE (RQ-1000/454)**

**4907210
UN1069**

Acetaldehyde is a clear colorless liquid with a pungent choking odor. It is used to make other chemicals. It has a flash point of -36 deg. F. and a boiling point of 69 deg. F. It is flammable over a wide vapor-air concentration range. Its vapors are irritating to the mucous membranes and especially the eyes. It is easily oxidized by air to form unstable peroxides which may explode. If it becomes contaminated, it may either react with the contaminant or polymerize, both with the evolution of heat. It is lighter than water and soluble in water. Its vapors are heavier than air.

It weighs 6.5 pounds per gallon.

If material on fire or involved in fire

Do not extinguish fire unless flow can be stopped

Use water in flooding quantities as fog

Solid streams of water may be ineffective

Cool all affected containers with flooding quantities of water

Apply water from as far a distance as possible

Use "alcohol" foam, carbon dioxide or dry chemical

If material not on fire and not involved in fire

Keep sparks, flames, and other sources of ignition away

Keep material out of water sources and sewers

Build dikes to contain flow as necessary

Attempt to stop leak if without hazard

Use water spray to disperse vapors and dilute standing pools of liquid

Personnel protection

Avoid breathing vapors

Keep upwind

Wear self-contained breathing apparatus

Avoid bodily contact with the material

Wear full protective clothing

Do not handle broken packages without protective equipment

Wash away any material which may have contacted the body with copious amounts of water or soap and water

Evacuation

If fire becomes uncontrollable or container is exposed to direct flame—evacuate for a radius of 2500 feet

If material leaking (not on fire), downwind evacuation must be considered

Environmental considerations—land spill

Dig a pit, pond, lagoon, holding area to contain liquid or solid material

Dike surface flow using soil, sand bags, foamed polyurethane, or foamed concrete

Absorb bulk liquid with fly ash, cement powder, sawdust, or commercial sorbents

Neutralize with sodium bisulfate (nahso4)

Environmental considerations—water spill

Add sodium bisulfate

If dissolved, apply activated carbon at ten times the spilled amount in region of 10ppm or greater concentration

Use mechanical dredges or lifts to remove immobilized masses of pollutants and precipitates

Environmental considerations—air spill

Apply water spray or mist to knock down vapors

ACETALDEHYDE AMMONIA

4941103

ORM-A

UN1841

ENVIRONMENTALLY HAZARDOUS SUBSTANCE (RQ-1000/454)

Acetaldehyde ammonia is a white crystalline solid. It is used to make other chemicals, vulcanize rubber, and for other uses. It is soluble in water. It will burn though it may take some effort to ignite. It can cause illness by inhalation, skin absorption and/or ingestion.

If material involved in fire

Extinguish fire using agent suitable for type of surrounding fire (Material itself does not burn or burns with difficulty.)

If material not involved in fire

Keep material out of water sources and sewers

Build dikes to contain flow as necessary

Personnel protection

Keep upwind

Wear boots, protective gloves, and goggles

Avoid breathing vapors or dusts

Wash away any material which may have contacted the body with copious amounts of water or soap and water

Environmental considerations—land spill

Dig a pit, pond, lagoon, holding area to contain liquid or solid material

Cover solids with a plastic sheet to prevent dissolving in rain or fire fighting water

Environmental considerations—water spill

Neutralize with dilute acid or removable strong acid

If dissolved, apply activated carbon at ten times the spilled amount in region of 10ppm or greater concentration

Use mechanical dredges or lifts to remove immobilized masses of pollutants and precipitates

ACETIC ACID (AQUEOUS SOLUTION) 4931401
CORROSIVE MATERIAL, ACIDIC UN2790
ENVIRONMENTALLY HAZARDOUS SUBSTANCE (RQ-1000/454)

Acetic acid (aqueous solution) is the solution of acetic acid in water having the odor of vinegar. It is corrosive to metals and tissue. It weighs 8.8 pounds per gallon.

If material on fire or involved in fire

- Use water in flooding quantities as fog
- Solid streams of water may be ineffective
- Cool all affected containers with flooding quantities of water
- Apply water from as far a distance as possible
- Use "alcohol" foam, carbon dioxide or dry chemical
- Use water spray to absorb vapors

If material not on fire and not involved in fire

- Keep sparks, flames, and other sources of ignition away
- Keep material out of water sources and sewers
- Build dikes to contain flow as necessary
- Use water spray to knock-down vapors
- Neutralize spilled material with crushed limestone, soda ash, or lime

Personnel protection

- Avoid breathing vapors
- Keep upwind
- Avoid bodily contact with the material
- Wear boots, protective gloves, and goggles
- Do not handle broken packages without protective equipment
- Wash away any material which may have contacted the body with copious amounts of water or soap and water
- If contact with the material anticipated, wear full protective clothing

Environmental considerations—land spill

- Dig a pit, pond, lagoon, holding area to contain liquid or solid material
- Dike surface flow using soil, sand bags, foamed polyurethane, or foamed concrete
- Absorb bulk liquid with fly ash or cement powder
- Neutralize with caustic soda or soda ash

Environmental considerations—water spill

- Add caustic soda

Environmental considerations—air spill

- Apply water spray or mist to knock down vapors
- Vapor knockdown water is corrosive or toxic and should be diked for containment

Personnel protection

- Avoid breathing vapors
- Keep upwind
- Avoid bodily contact with the material
- Wear boots, protective gloves, and goggles
- Do not handle broken packages without protective equipment
- Wash away any material which may have contacted the body with copious amounts of water or soap and water
- If contact with the material anticipated, wear full protective clothing

Environmental considerations—land spill

- Dig a pit, pond, lagoon, holding area to contain liquid or solid material
- Dike surface flow using soil, sand bags, foamed polyurethane, or foamed concrete
- Absorb bulk liquid with fly ash or cement powder
- Neutralize with caustic soda or soda ash

Environmental considerations—water spill

- Add caustic soda

Environmental considerations—air spill

- Apply water spray or mist to knock down vapors
- Vapor knockdown water is corrosive or toxic and should be diked for containment

ACETIC ANHYDRIDE 4931304
CORROSIVE MATERIAL, ACIDIC, COMBUSTIBLE UN1715
ENVIRONMENTALLY HAZARDOUS SUBSTANCE (RQ-1000/454)

Acetic anhydride is a clear colorless liquid with a strong odor of vinegar. It is used to make fibers, plastics, pharmaceuticals, dyes, and explosives. It is combustible and has a flash point of 129 deg. F. It is soluble in water and is readily decomposed by water to acetic acid with release of heat. It is corrosive to metals and tissue. It weighs 9.0 pounds per gallon.

If material on fire or involved in fire

- Use water in flooding quantities as fog
- Solid streams of water may be ineffective
- Cool all affected containers with flooding quantities of water
- Apply water from as far a distance as possible
- Use "alcohol" foam, carbon dioxide or dry chemical
- Use water spray to absorb vapors

If material not on fire and not involved in fire

- Keep sparks, flames, and other sources of ignition away
- Keep material out of water sources and sewers
- Build dikes to contain flow as necessary
- Use water spray to knock-down vapors
- Do not use water on material itself
- Neutralize spilled material with crushed limestone, soda ash, or lime

Personnel protection

- Avoid breathing vapors
- Keep upwind
- Avoid bodily contact with the material
- Wear boots, protective gloves, and goggles
- Do not handle broken packages without protective equipment
- Wash away any material which may have contacted the body with copious amounts of water or soap and water
- If contact with the material anticipated, wear full protective clothing

Environmental considerations—land spill

- Dig a pit, pond, lagoon, holding area to contain liquid or solid material
- Dike surface flow using soil, sand bags, foamed polyurethane, or foamed concrete
- Absorb bulk liquid with fly ash or cement powder
- Neutralize with caustic soda or soda ash

Environmental considerations—water spill

- Add caustic soda

Environmental considerations—air spill

- Apply water spray or mist to knock down vapors
- Vapor knockdown water is corrosive or toxic and should be diked for containment

ACETIC ACID, GLACIAL 4931303
CORROSIVE MATERIAL, ACIDIC, COMBUSTIBLE UN2789
ENVIRONMENTALLY HAZARDOUS SUBSTANCE (RQ-1000/454)

Acetic acid, glacial is a clear colorless liquid with a strong odor of vinegar. It is used to make other chemicals, as a food additive, and in petroleum production. It is combustible and has a flash point of 104 deg. F. It is soluble in water with release of heat. It is corrosive to metals and tissue.

It weighs 8.8 pounds per gallon.

If material on fire or involved in fire

- Use water in flooding quantities as fog
- Solid streams of water may be ineffective
- Cool all affected containers with flooding quantities of water
- Apply water from as far a distance as possible
- Use "alcohol" foam, carbon dioxide or dry chemical
- Use water spray to absorb vapors

If material not on fire and not involved in fire

- Keep sparks, flames, and other sources of ignition away
- Keep material out of water sources and sewers
- Build dikes to contain flow as necessary
- Use water spray to knock-down vapors
- Neutralize spilled material with crushed limestone, soda ash, or lime

**ACETONE
FLAMMABLE LIQUID**

**4908105
UN1090**

Acetone is a clear, colorless liquid with a pleasant odor. It is used to make other chemicals, in paint and nail polish removers, as a solvent, and for other uses. It is quite volatile and has a flash point of 0 deg. F. It is lighter than water and soluble in water. Its vapors are heavier than air.

If material on fire or involved in fire

- Do not extinguish fire unless flow can be stopped
- Use water in flooding quantities as fog
- Solid streams of water may be ineffective
- Cool all affected containers with flooding quantities of water
- Apply water from as far a distance as possible
- Use "alcohol" foam, carbon dioxide or dry chemical

If material not on fire and not involved in fire

- Keep sparks, flames, and other sources of ignition away
- Keep material out of water sources and sewers
- Build dikes to contain flow as necessary
- Attempt to stop leak if without hazard
- Use water spray to disperse vapors and dilute standing pools of liquid

Personnel protection

- Avoid breathing vapors
- Keep upwind
- Wear boots, protective gloves, and goggles
- Do not handle broken packages without protective equipment
- Wash away any material which may have contacted the body with copious amounts of water or soap and water

Evacuation

- If fire becomes uncontrollable or container is exposed to direct flame—evacuate for a radius of 1500 feet
- If material leaking (not on fire), downwind evacuation must be considered

**ACETONE CYANOHYDRIN
POISON 8, COMBUSTIBLE
ENVIRONMENTALLY HAZARDOUS SUBSTANCE (RQ-10/4.54)**

**4921401
UN1541**

Acetone cyanohydrin is a colorless liquid. It has a flash point of 165 deg. F. It slowly dissociates to acetone, a flammable liquid, and hydrogen cyanide, a flammable poisonous gas, under normal storage and transportation conditions. The rate of dissociation is increased by contact with alkalis and/or heat. It is lethal by inhalation and less readily by skin absorption. It is lighter than water and soluble in water. Its vapors are heavier than air. Toxic oxides of nitrogen are produced during combustion of this material.

It weighs 7.8 pounds per gallon.

If material on fire or involved in fire

- Do not extinguish fire unless flow can be stopped
- Use water in flooding quantities as fog
- Solid streams of water may be ineffective
- Cool all affected containers with flooding quantities of water
- Apply water from as far a distance as possible
- Use "alcohol" foam, carbon dioxide or dry chemical
- Keep run-off water out of sewers and water sources

If material not on fire and not involved in fire

- Keep sparks, flames, and other sources of ignition away
- Keep material out of water sources and sewers
- Build dikes to contain flow as necessary
- Attempt to stop leak if without hazard
- Use water spray to disperse vapors and dilute standing pools of liquid

Personnel protection

- Avoid breathing vapors
- Keep upwind
- Wear self-contained breathing apparatus
- Avoid bodily contact with the material
- Wear full protective clothing
- Do not handle broken packages without protective equipment
- Wash away any material which may have contacted the body with copious amounts of water or soap and water

Evacuation

- If material leaking (not on fire), downwind evacuation must be considered

Environmental considerations—land spill

- Dig a pit, pond, lagoon, holding area to contain liquid or solid material
- Dike surface flow using soil, sand bags, foamed polyurethane, or foamed concrete

Absorb bulk liquid with fly ash or cement powder

Environmental considerations—water spill

- Use natural barriers or oil spill control booms to limit spill motion
- Use surface active agent (e.g. detergent, soaps, alcohols) to compress and thicken spilled material
- If dissolved, apply activated carbon at ten times the spilled amount in region of 10ppm or greater concentration
- Adjust pH to neutral (pH-7)
- Use mechanical dredges or lifts to remove immobilized masses of pollutants and precipitates

**ACETONE OIL
FLAMMABLE LIQUID**

**4908106
UN1091**

Acetone oils are clear amber colored liquids. Their flash point is in the range of 50-100 deg. F. It is lighter than water and is soluble in water. Its vapors are heavier than air.

If material on fire or involved in fire

- Do not extinguish fire unless flow can be stopped
- Use water in flooding quantities as fog
- Solid streams of water may be ineffective
- Cool all affected containers with flooding quantities of water
- Apply water from as far a distance as possible
- Use "alcohol" foam, carbon dioxide or dry chemical

If material not on fire and not involved in fire

- Keep sparks, flames, and other sources of ignition away
- Keep material out of water sources and sewers
- Build dikes to contain flow as necessary
- Attempt to stop leak if without hazard
- Use water spray to disperse vapors and dilute standing pools of liquid

Personnel protection

- Avoid breathing vapors
- Keep upwind
- Wear boots, protective gloves, and goggles
- Do not handle broken packages without protective equipment
- Wash away any material which may have contacted the body with copious amounts of water or soap and water

Evacuation

- If fire becomes uncontrollable or container is exposed to direct flame—evacuate for a radius of 1500 feet
- If material leaking (not on fire), downwind evacuation must be considered

**ACETONITRILE
FLAMMABLE LIQUID, POISONOUS**

**4907405
NA1648**

Acetonitrile is a clear colorless liquid with an ethereal odor. It has a flash point of 42 deg. F. It is toxic by skin absorption. It is lighter than water and soluble in water. Its vapors are heavier than air. Toxic oxides of nitrogen are produced during combustion of this material.

If material on fire or involved in fire

- Do not extinguish fire unless flow can be stopped
- Use water in flooding quantities as fog
- Solid streams of water may be ineffective
- Cool all affected containers with flooding quantities of water
- Apply water from as far a distance as possible
- Use "alcohol" foam, carbon dioxide or dry chemical

Continued on next page

If material not on fire and not involved in fire
Keep sparks, flames, and other sources of ignition away
Keep material out of water sources and sewers
Build dikes to contain flow as necessary
Attempt to stop leak if without hazard
Use water spray to disperse vapors and dilute standing pools of liquid

Personnel protection

Avoid breathing vapors
Keep upwind
Wear self-contained breathing apparatus
Avoid bodily contact with the material
Wear boots, protective gloves, and goggles
Do not handle broken packages without protective equipment
Wash away any material which may have contacted the body with copious amounts of water or soap and water
If contact with the material anticipated, wear full protective clothing

Evacuation

If fire becomes uncontrollable or container is exposed to direct flame—evacuate for a radius of 1500 feet
If material leaking (not on fire), downwind evacuation must be considered

ACETYL BENZOYL PEROXIDE SOLUTION (NOT OVER 40% PEROXIDE) 4919505

ORGANIC PEROXIDE UN2081

Acetyl benzoyl peroxide solution is a clear colorless liquid. The solution cannot be more than 40% acetyl benzoyl peroxide in a non-volatile solvent. The solution may take some effort to ignite but once ignited it burns with increasing rapidity. The dried material is quite easily ignited and burns with increasing rapidity. The dried material if contaminated with combustible material can form explosive mixtures. Under prolonged exposure to fire or heat containers of the material may explode.

If material on fire or involved in fire

Use water in flooding quantities as fog
Solid streams of water may be ineffective
Cool all affected containers with flooding quantities of water
Apply water from as far a distance as possible
Use "alcohol" foam, carbon dioxide or dry chemical
Dangerously explosive

If material not on fire and not involved in fire

Keep sparks, flames, and other sources of ignition away
Keep material out of water sources and sewers
Build dikes to contain flow as necessary
Use water spray to knock-down vapors
Keep spilled material wet
Wet spilled material before picking it up

Personnel protection

Avoid breathing vapors
Keep upwind
Avoid bodily contact with the material
Wear boots, protective gloves, and goggles
Do not handle broken packages without protective equipment
Wash away any material which may have contacted the body with copious amounts of water or soap and water
Wear self-contained breathing apparatus when fighting fires involving this material
If contact with the material anticipated, wear full protective clothing
Approach fire with caution

Evacuation

If the material is on fire or involved in fire evacuate for a radius of 2500 feet

ACETYL BROMIDE

CORROSIVE MATERIAL, ACIDIC

ENVIRONMENTALLY HAZARDOUS SUBSTANCE (RQ-5000/2270) 4931705

UN1716

Acetyl bromide is a colorless fuming liquid with a pungent odor. It is decomposed by water to acetic and hydrobromic acids with release of heat. Its vapors are irritating to the eyes and mucous membranes. It is corrosive to metals and tissue.

It weighs 13.9 pounds per gallon.

If material on fire or involved in fire

Use dry chemical or carbon dioxide
Do not use water on material itself
If large quantities of combustibles are involved, use water in flooding quantities as spray and fog
Use water spray to absorb vapors
Cool all affected containers with flooding quantities of water
Apply water from as far a distance as possible

If material not on fire and not involved in fire

Keep sparks, flames, and other sources of ignition away
Keep material out of water sources and sewers
Build dikes to contain flow as necessary
Use water spray to knock-down vapors
Do not use water on material itself
Neutralize spilled material with crushed limestone, soda ash, or lime

Personnel protection

Avoid breathing vapors
Keep upwind
Avoid bodily contact with the material
Wear boots, protective gloves, and goggles
Do not handle broken packages without protective equipment
Wash away any material which may have contacted the body with copious amounts of water or soap and water
If contact with the material anticipated, wear full protective clothing

Environmental considerations—land spill

Dig a pit, pond, lagoon, holding area to contain liquid or solid material
Dike surface flow using soil, sand bags, foamed polyurethane, or foamed concrete

Absorb bulk liquid with fly ash or cement powder

Environmental considerations—water spill

If dissolved, apply activated carbon at ten times the spilled amount in region of 10ppm or greater concentration
Adjust pH to neutral (pH-7)

Use mechanical dredges or lifts to remove immobilized masses of pollutants and precipitates

Environmental considerations—air spill

Apply water spray or mist to knock down vapors
Vapor knockdown water is corrosive or toxic and should be diked for containment

ACETYL IODIDE

CORROSIVE MATERIAL, ACIDIC

4931707

UN1898

Acetyl iodide is a colorless, fuming liquid with a pungent odor. Its vapors are irritating to the eyes and mucous membranes. It is decomposed by water to acetic and hydroiodic acids with release of heat. It is corrosive to metals and skin.

If material on fire or involved in fire

Use dry chemical or carbon dioxide
Do not use water on material itself
If large quantities of combustibles are involved, use water in flooding quantities as spray and fog
Use water spray to absorb vapors
Cool all affected containers with flooding quantities of water
Apply water from as far a distance as possible

If material not on fire and not involved in fire

Keep sparks, flames, and other sources of ignition away
Keep material out of water sources and sewers
Build dikes to contain flow as necessary
Use water spray to knock-down vapors
Do not use water on material itself
Neutralize spilled material with crushed limestone, soda ash, or lime

Personnel protection

- Avoid breathing vapors
- Keep upwind
- Wear self-contained breathing apparatus
- Avoid bodily contact with the material
- Wear full protective clothing
- Do not handle broken packages without protective equipment
- Wash away any material which may have contacted the body with copious amounts of water or soap and water

Evacuation

- If fire becomes uncontrollable or container is exposed to direct flame—evacuate for a radius of 1500 feet
- If material leaking (not on fire), downwind evacuation must be considered

Environmental considerations—land spill

- Dig a pit, pond, lagoon, holding area to contain liquid or solid material
- Dike surface flow using soil, sand bags, foamed polyurethane, or foamed concrete
- Absorb bulk liquid with fly ash, cement powder, sawdust, or commercial sorbents
- Neutralize with agricultural lime (slaked lime), crushed limestone, or sodium bicarbonate
- Apply "universal" gelling agent to immobilize spill

Environmental considerations—water spill

- If dissolved, apply activated carbon at ten times the spilled amount in region of 10ppm or greater concentration
- Neutralize with agricultural lime (slaked lime), crushed limestone, or sodium bicarbonate
- Use mechanical dredges or lifts to remove immobilized masses of pollutants and precipitates

Environmental considerations—air spill

- Apply water spray or mist to knock down vapors
- Vapor knockdown water is corrosive or toxic and should be diked for containment

ACETYL CYCLOHEXANESULPHONYL PEROXIDE, 4919103 (NOT MORE THAN 32% IN SOLUTION) ORGANIC PEROXIDE UN2083

Acetyl cyclohexanesulphonyl peroxide, (not more than 32% in solution) is a white solid. It is used to manufacture paints, plastics, and rubber. It is insoluble in water. It is easily ignited and burns with increasing rapidity as the fire progresses. It can form explosive mixtures with finely divided combustible materials. It supports the burning of combustible materials. Under prolonged exposure to fire or heat containers of the material may explode.

If material on fire or involved in fire

- Use water in flooding quantities as fog
- Solid streams of water may be ineffective
- Cool all affected containers with flooding quantities of water
- Apply water from as far a distance as possible
- Use "alcohol" foam, carbon dioxide or dry chemical
- Dangerously explosive

If material not on fire and not involved in fire

- Keep sparks, flames, and other sources of ignition away
- Keep material out of water sources and sewers
- Keep spilled material wet
- Wet spilled material before picking it up

Personnel protection

- Avoid breathing dusts, and fumes from burning material
- Avoid bodily contact with the material
- Wear boots, protective gloves, and goggles
- Do not handle broken packages without protective equipment
- Wash away any material which may have contacted the body with copious amounts of water or soap and water

Wear self-contained breathing apparatus when fighting fires involving this material

- If contact with the material anticipated, wear full protective clothing
- Approach fire with caution

Evacuation

- If the material is on fire or involved in fire evacuate for a radius of 2500 feet

ACETYL CYCLOHEXANESULPHONYL PEROXIDE, 4919104 (NOT MORE THAN 82%, WETTED WITH NOT LESS THAN 12% WATER)

ORGANIC PEROXIDE UN2082

Acetyl cyclohexanesulphonyl peroxide, (not more than 82%, wetted with not less than 12% water) is a white solid. It is used to manufacture paints, plastics, and rubber. It is insoluble in water. It is easily ignited and burns with increasing rapidity as the fire progresses. It can form explosive mixtures with finely divided combustible materials. It supports the burning of combustible materials. Under prolonged exposure to fire or heat containers of the material may explode.

If material on fire or involved in fire

- Use water in flooding quantities as fog
- Solid streams of water may be ineffective
- Cool all affected containers with flooding quantities of water
- Apply water from as far a distance as possible
- Use "alcohol" foam, carbon dioxide or dry chemical
- Dangerously explosive

If material not on fire and not involved in fire

- Keep sparks, flames, and other sources of ignition away
- Keep material out of water sources and sewers
- Keep spilled material wet
- Wet spilled material before picking it up

Personnel protection

- Avoid breathing dusts, and fumes from burning material
- Avoid bodily contact with the material
- Wear boots, protective gloves, and goggles
- Do not handle broken packages without protective equipment
- Wash away any material which may have contacted the body with copious amounts of water or soap and water
- Wear self-contained breathing apparatus when fighting fires involving this material
- If contact with the material anticipated, wear full protective clothing
- Approach fire with caution

Evacuation

- If the material is on fire or involved in fire evacuate for a radius of 2500 feet

ACETYL CHLORIDE 4907601 FLAMMABLE LIQUID, CORROSIVE UN1717 ENVIRONMENTALLY HAZARDOUS SUBSTANCE (RQ-5000/2270)

Acetyl chloride is a colorless, fuming liquid with a pungent odor. It has a flash point of 40 deg. F. Its vapors are irritating to the eyes and mucous membranes. It is decomposed by water to acetic and hydrochloric acids with release of heat. It is corrosive to metals and tissue. Its vapors are heavier than air.

It weighs 9.2 pounds per gallon.

If material on fire or involved in fire

- Use dry chemical or carbon dioxide
- Do not use water on material itself
- If large quantities of combustibles are involved, use water in flooding quantities as spray and fog
- Use water spray to absorb vapors
- Cool all affected containers with flooding quantities of water
- Apply water from as far a distance as possible

Continued on next page

If material not on fire and not involved in fire
 Keep sparks, flames, and other sources of ignition away
 Keep material out of water sources and sewers
 Build dikes to contain flow as necessary
 Attempt to stop leak if without hazard
 Use water spray to knock-down vapors
 Do not use water on material itself
 Neutralize spilled material with crushed limestone, soda ash, or lime

Personnel protection

Avoid breathing vapors
 Keep upwind
 Wear self-contained breathing apparatus
 Avoid bodily contact with the material
 Wear boots, protective gloves, and goggles
 Do not handle broken packages without protective equipment
 Wash away any material which may have contacted the body with copious amounts of water or soap and water
 If contact with the material anticipated, wear full protective clothing

ACETYL PEROXIDE SOLUTION, (NOT OVER 25% PEROXIDE) 4919510

ORGANIC PEROXIDE UN2084

Acetyl peroxide, solution is a clear colorless liquid. The solution cannot contain more than 25% acetyl peroxide in a non-volatile solvent. The solution may take some effort to ignite but once ignited it burns with increasing rapidity. The dried material is quite easily ignited and burns with increasing rapidity. If contaminated with combustible material, the dried material can form explosive mixtures. Under prolonged exposure to heat or fire containers of the material may explode.

If material on fire or involved in fire

Use water in flooding quantities as fog
 Solid streams of water may be ineffective
 Cool all affected containers with flooding quantities of water
 Apply water from as far a distance as possible
 Use "alcohol" foam, carbon dioxide or dry chemical
 Dangerously explosive

If material not on fire and not involved in fire

Keep sparks, flames, and other sources of ignition away
 Keep material out of water sources and sewers
 Build dikes to contain flow as necessary
 Use water spray to knock-down vapors
 Keep spilled material wet

Personnel protection

Avoid breathing vapors
 Keep upwind
 Avoid bodily contact with the material
 Wear boots, protective gloves, and goggles
 Do not handle broken packages without protective equipment
 Wash away any material which may have contacted the body with copious amounts of water or soap and water
 Wear self-contained breathing apparatus when fighting fires involving this material
 If contact with the material anticipated, wear full protective clothing
 Approach fire with caution

Evacuation

If the material is on fire or involved in fire evacuate for a radius of 2500 feet

ACETYLENE 4906701 FLAMMABLE GAS UN1001

Acetylene is a colorless gas with a faint garlic like odor. It is easily ignited and burns with a sooty flame. It may only be shipped in cylinders, and that only of one type that may be used for no other commodity. The gas is lighter than air but a flame can flash back to the source of a leak very easily. Under fire conditions, cylinders may violently rupture and rocket.

If material on fire or involved in fire

Do not extinguish fire unless flow can be stopped
 Use water in flooding quantities as fog
 Cool all affected containers with flooding quantities of water
 Apply water from as far a distance as possible

If material not on fire and not involved in fire

Keep sparks, flames, and other sources of ignition away
 Keep material out of water sources and sewers
 Attempt to stop leak if without hazard
 Use water spray to knock-down vapors

Personnel protection

Avoid breathing vapors
 Keep upwind
 Wear protective gloves and goggles
 Do not handle broken packages without protective equipment
 Approach fire with caution

Evacuation

If fire becomes uncontrollable or container is exposed to direct flame—evacuate for a radius of 1500 feet
 If material leaking (not on fire), downwind evacuation must be considered

ACID FISH SCRAP (FISH SCRAP (CONTAINING LESS THAN 6% OR MORE THAN 12% MOISTURE)) 4917461

FLAMMABLE SOLID NA1374

Acid fish scrap that is too dry is liable to spontaneous heating and ignition; or too wet is liable to decay, spontaneous heating and ignition.

If material on fire or involved in fire

Flood with water

If material not on fire and not involved in fire

Keep sparks, flames, and other sources of ignition away

ACID, NEC, DRY, ORGANIC (CORROSIVE SOLID, N.O.S.) 4931403

CORROSIVE MATERIAL, ACIDIC UN1759

Acid, nec, dry, organic is a solid material having the property of being corrosive to metals and/or tissue.

If material on fire or involved in fire

Use water in flooding quantities as fog
 Cool all affected containers with flooding quantities of water
 Apply water from as far a distance as possible
 Use "alcohol" foam, carbon dioxide or dry chemical

If material not on fire and not involved in fire

Keep sparks, flames, and other sources of ignition away
 Keep material out of water sources and sewers
 Neutralize spilled material with crushed limestone, soda ash, or lime

Personnel protection

Avoid breathing fumes from burning material
 Keep upwind
 Avoid bodily contact with the material
 Wear boots, protective gloves, and goggles
 Do not handle broken packages without protective equipment
 Wash away any material which may have contacted the body with copious amounts of water or soap and water
 If contact with the material anticipated, wear full protective clothing

ACIDS, CHEMICAL AND OTHER ARTICLES, MIXED LOAD 4950110

Consult the shipping papers for the exact contents of the car, container, or trailer.