A Guide to the

Safe Handling of Hazardous Materials Accidents: Second Edition

MANUAL 10

A GUIDE TO THE SAFE HANDLING OF HAZARDOUS MATERIALS ACCIDENTS

Second Edition

A Special Card Insert, "Initial Emergency Assessment—Initial Response Action," will be found inside the back cover

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This revised edition of ASTM STP 825, now designated Manual 10, is the product of the active members of F20.2000, Hazardous Materials Spill Response, from 1986 to 1990.

CONTENTS

CHARTS

PURPOSE STATEMENT

The material contained in this manual is intended to be used in planning and training. Planning a response and training personnel are necessary to assure the safest, most effective handling of a hazardous material incident. It must be recognized that all plans are subject to modification based on the actual facts of the situation. The flow charts are designed to assist the on-scene emergency responder in the decision-making process during the handling of a hazardous material incident.

INTRODUCTION

In emergency situations the hazard classification system of the Department of Transportation (DOT) is useful, familiar, and available on the scene. This manual is arranged by DOT hazard class and shipment volume. The exception is the Section on Water-Sensitive Liquids (page 59), which is not a DOT class. Within some classes, a distinction is made between bulk and package shipments. Bulk shipments are those that equal or exceed 110 gallons liquid (415 liters) or 1000 pounds dry (450 kilograms) measure, such as tank car or tank truck. Package shipments are those that are less than 110 gallons liquid (415 liters) or 1000 pounds dry (450 kilograms) measure per package.

The text of the manual describes the DOT hazard classes, the terms used in describing the classes or materials, and emergency control tactics.

Two symbols are used in the flow charts. The diamond indicates a condition and should be read as a question: "Does this condition exist?" The rectangle recommends an action or provides information.

The charts are arranged by hazard class and shipment volume, both shown in the upper right-hand corner of each chart. Once the appropriate chart has been located, answer the condition questions starting in the upper left-hand corner and proceed as directed by the answers *Yes* or *No* until the action recommendation is reached. If the situation changes, repeat the process.

Accidents involving multiple hazard classifications pose risks not adequately addressed by single-hazard class decision charts. These charts do not address possible results of mixing various materials.

All evacuation distances are for protection of emergency response personnel. It would be prudent to move the public further away to provide maneuvering room for emergency response personnel.

EXPLOSIVES

DOT CLASSES

Class A Explosive, Class B Explosive, Class C Explosive

Note **These classes form a continuum of decreasing explosive hazard in the order given.**

DEFINITIONS

Detonation The extremely rapid, self-propagating decomposition of an explosive with a high pressure temperature wave that moves at speeds of 1000 to 9000 m/s.

Explosive Any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion (i.e., with substantially instantaneous release of gas and heat).

Class A Explosive An explosive of detonating or otherwise maximum hazard.

Class B Explosive An explosive that functions by rapid combustion rather than detonation. This class includes:

1. Liquid or solid propellant explosives.
2. Some explosive devices such as special fireworks.
3. Some pyrotechnic signal devices.
4. Some smokeless powders.

Class C Explosive Manufactured articles containing Class A or Class B explosives, or both, as components but in restricted quantities, including certain types of fireworks.

ALL SHIPMENTS

If an explosion occurs as the result of an accident, the only thing that can be done is to care for any injured persons and to prevent the spread of fire sometimes caused by explosions.

If a fire has started near explosives, every effort should be made to put out the fire safely or to remove the explosives to a safer place. Some explosives detonate immediately on ignition, others may burn for some time before exploding, others may be completely consumed without any explosion. Owing to the extreme likelihood of the detonation of burning explosives, efforts to extinguish burning explosives are *not* recommended. Application of water to burning Class A or Class B explosives may precipitate an explosion. Evacuate everyone to a distance of 5000 feet (1500 meters) if Class A explosives or 2500 feet (750 meters) if Class B

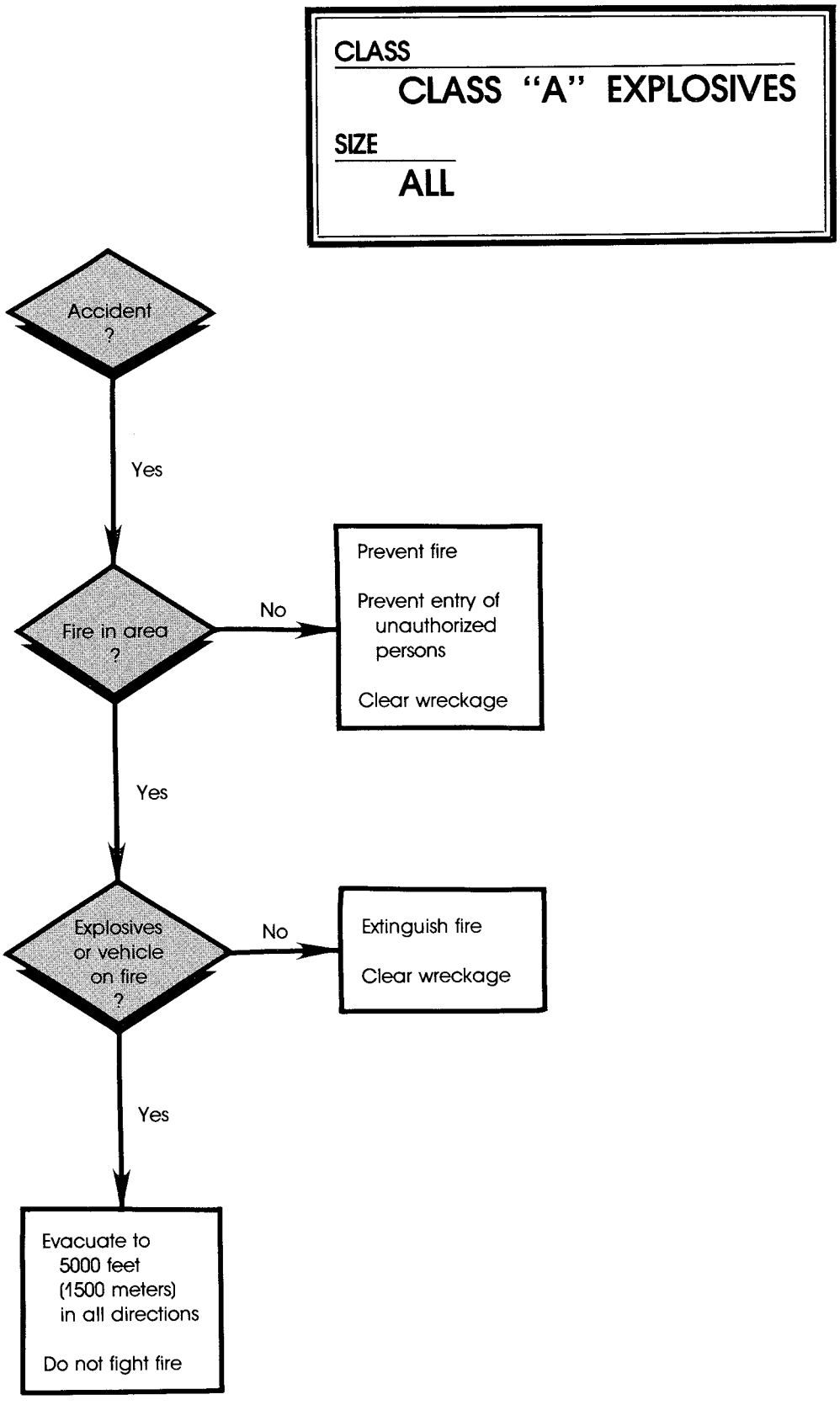
explosives are involved in a fire. For Class C explosives, consult the decision mechanism chart on page 9.

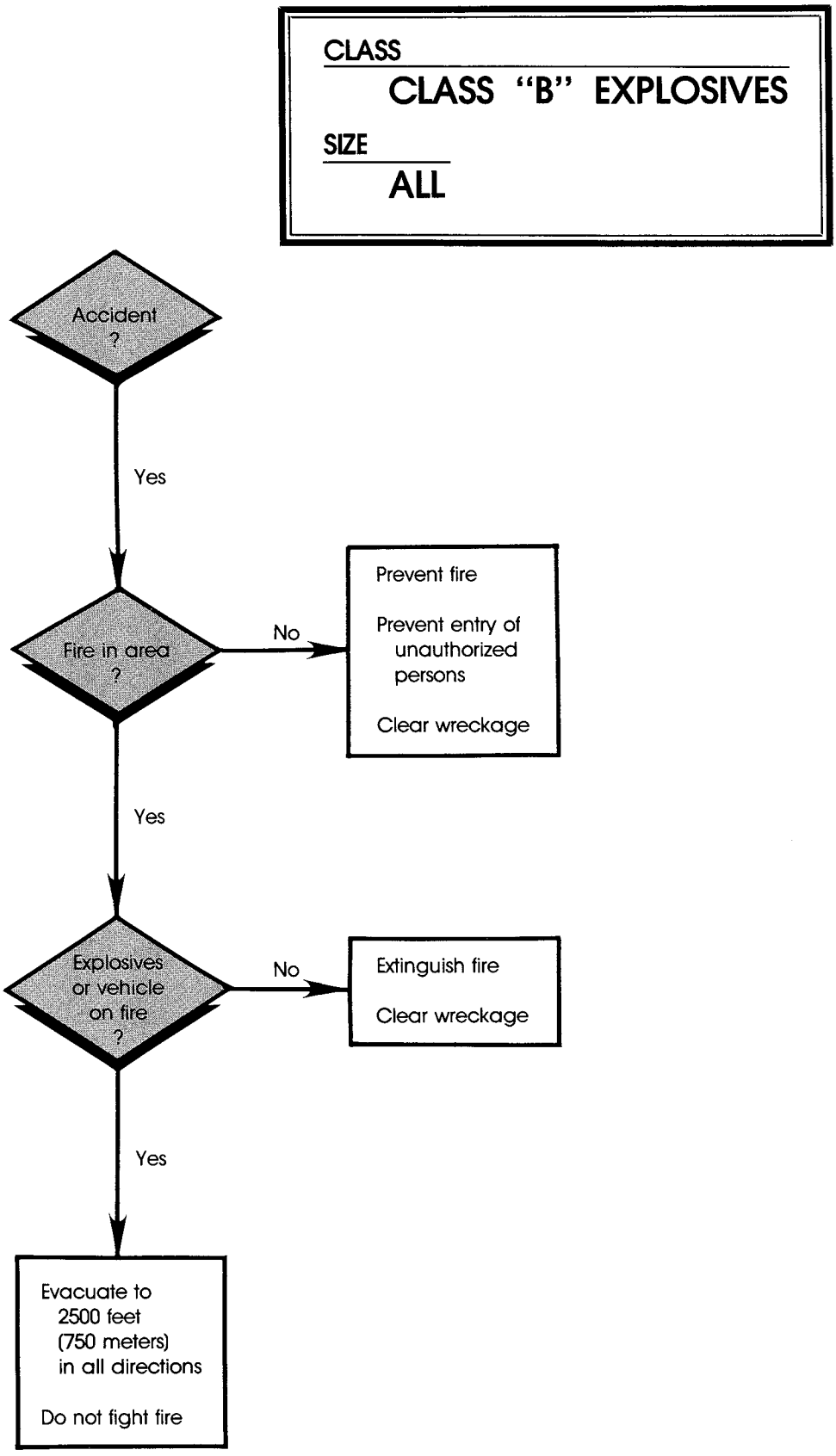
If the accident does not cause the immediate ignition or explosion of the explosives, the most important precaution is to prevent fire. The area should be guarded to keep away all unauthorized persons. Before clearing a wreck in which a vehicle containing explosives is involved, contact the shipper for detailed advice and assistance.

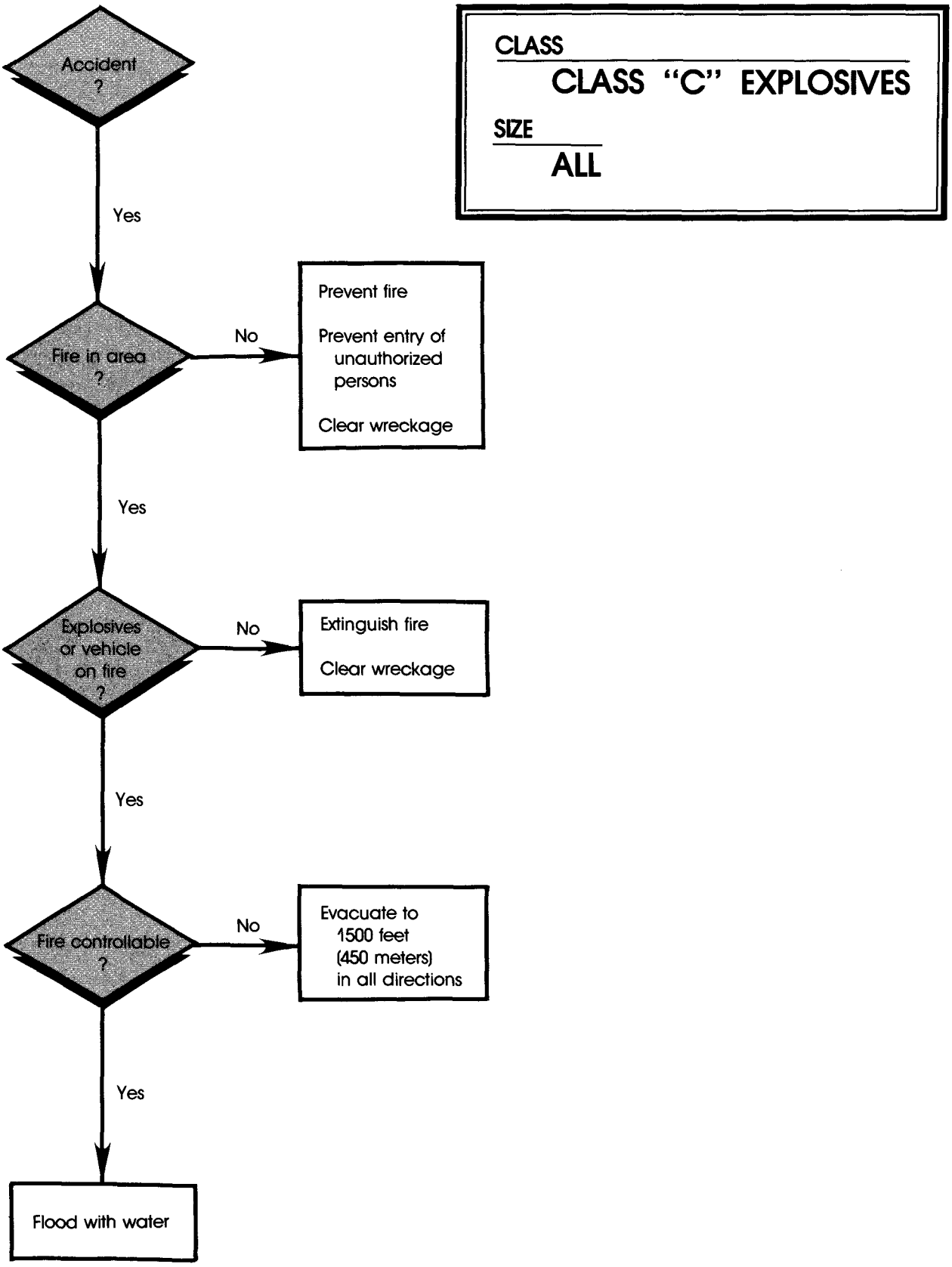
If the wreck involves a vehicle containing chemical ammunition, every precaution must be taken to prevent fire and casualties from gas leakage. Only those persons necessary to clear the wreckage should be allowed in the vicinity, and they should be adequately protected against any escaping gas.

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. Propellant explosives may be in the form of very fine grains or extremely large solid pieces weighing several tons (5 tons is about 450 kilograms). Class B explosives are not likely to explode because of impact or friction, although ignition of such explosives by friction is possible. Care must be exercised in 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 with rapidity approaching explosive violence when ignited. Care must be exercised to avoid unnecessary inhalation of smoke, since the products of combustion of a few kinds of propellant explosives are poisonous.

In all cases where explosives are involved in fires or serious accidents on the railroad, the Association of American Railroads, Bureau of Explosives (202/639-2222; 24 hours), should be notified. A Bureau of Explosives representative will assist in determining whether the particular kind of explosive involved in the accident may have caused contamination of the area with explosive or toxic materials so that necessary procedures for decontamination may be organized.


CLASS
CLASS "A" EXPLOSIVES
SIZE
ALL
Accident ?
Yes
Fire in area ?
No
Prevent fire
Prevent entry of unauthorized persons
Clear wreckage
Yes
Explosives or vehicle on fire ?
No
Extinguish fire
Clear wreckage
Yes
Evacuate to 5000 feet (1500 meters) in all directions
Do not fight fire


CLASS
CLASS "B" EXPLOSIVES
SIZE
ALL
Accident ?
Yes
Fire in area ?
No
Prevent fire
Prevent entry of unauthorized persons
Clear wreckage
Yes
Explosives or vehicle on fire ?
No
Extinguish fire
Clear wreckage
Yes
Evacuate to 2500 feet (750 meters) in all directions
Do not fight fire


CLASS
CLASS "C" EXPLOSIVES
SIZE
ALL
Accident ?
Yes
Fire in area ?
No
Prevent fire
Prevent entry of unauthorized persons
Clear wreckage
Yes
Explosives or vehicle on fire ?
No
Extinguish fire
Clear wreckage
Yes
Fire controllable ?
No
Evacuate to 1500 feet (450 meters) in all directions
Yes
Flood with water

OXIDIZER

DOT CLASS

Oxidizer

DEFINITION

A substance that yields oxygen readily to stimulate the combustion of organic matter.

> Certain other materials not even containing oxygen can "oxidize" other molecules. Methane (natural gas, UN 1971, 1972), for example, will burn or "oxidize" in chlorine or fluorine as easily as in oxygen. In this category are chlorine, fluorine, and bromine as well as others.
>
> Many inorganic materials also undergo stimulated combustion with oxidizers (i.e., sodium, magnesium, silicon, titanium, and so forth).

BULK SHIPMENTS

A few oxidizers are shipped as bulk liquids, and most of the liquids will cause fire by contact with combustible material. Nitric acid, mixed acid, perchloric acid, or hydrogen peroxide may cause fire when brought into contact with combustible materials.

Fires caused by these materials are best extinguished by flooding with water. Water should be used in sufficient quantity to extinguish the fire and to dilute and wash away the liquid. Contact of the water with acids may cause explosions and projection of acid, so apply a stream of water onto the fire from a safe distance. The reddish fumes caused by fires from nitric acid or mixed acids including aqua regia are irritating and poisonous. Do not expose personnel to such fumes unless they are equipped with self-contained breathing apparatus. If it is necessary to transfer the contents of tanks, call upon the shipper or the nearest manufacturer of these liquids for assistance.

> NITROGEN TETROXIDE (UN 1067, CAS 10544-72-6) FIRES WITH HYDROCARBONS MAY BE IMPOSSIBLE TO EXTINGUISH WITH WATER.

Ammonium nitrate, ammonium nitrate fertilizer, sodium nitrate, and other nitrates usually will not burn alone, but when intimately mixed with organic matter they will burn strongly if ignited. The heat of burning melts the nitrate, which may then ignite any combustible material it touches. Melted nitrate holds a great

deal of heat; when water is thrown on it, the sudden generation of steam will cause the melted nitrate to scatter and possibly start a fresh fire. Whenever practicable, fires in nitrate shipments should be smothered with dry earth or sand. Water may be used if the fire is small. The use of water on a large nitrate fire is seldom effective.

> Ammonium nitrate, ammonium perchlorate, and others in this category may detonate when pure or contaminated or mixed with other materials.

PACKAGE SHIPMENTS

In accidents involving chlorates or other oxidizing materials in packages bearing oxidizer labels, care is necessary to prevent ignition of these articles by friction or contact with shipments of acids. When chlorates are mixed with organic matter, or even dust, they form very flammable mixtures. Chlorates mixed with finely divided combustible material may burn with explosive violence. Chlorates in contact with sulfuric acid are likely to cause fire or explosion.

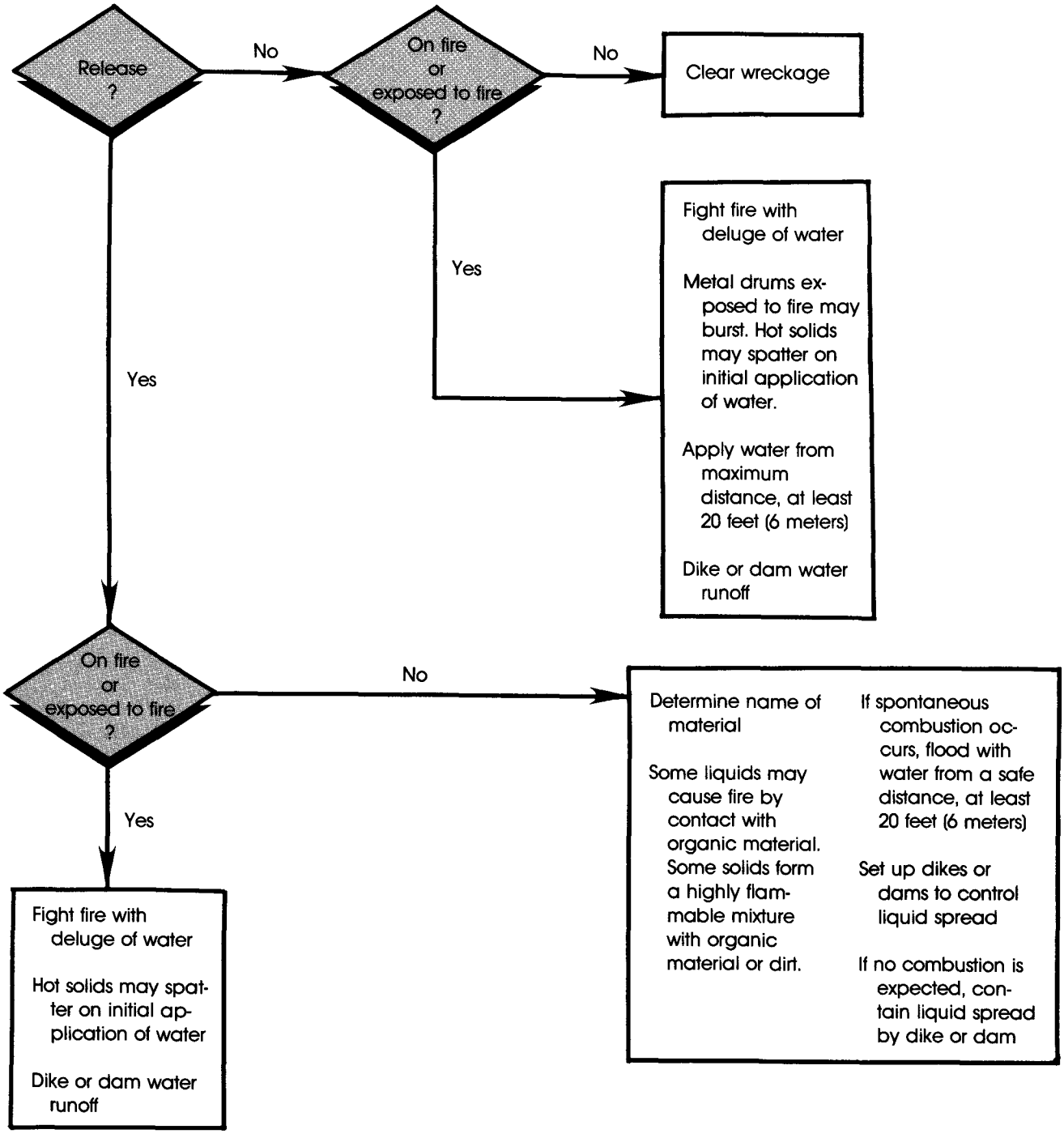
Fire may be caused by leaking of nitric acid, mixed acid, perchloric acid, or hydrogen peroxide. These materials are also corrosive. The acids give off irritating and poisonous fumes. Such fires should be extinguished by flooding with water.

CLASS

OXIDIZER

SIZE

ALL



ORGANIC PEROXIDE

DOT CLASS

Organic Peroxide (includes Hydroperoxides)

DEFINITION

An organic compound containing the bivalent peroxide —O—O— or the R—O—O—H (hydroperoxide) structure and which may be considered a derivative of hydrogen peroxide where one or more of the hydrogen atoms have been replaced by organic radicals.

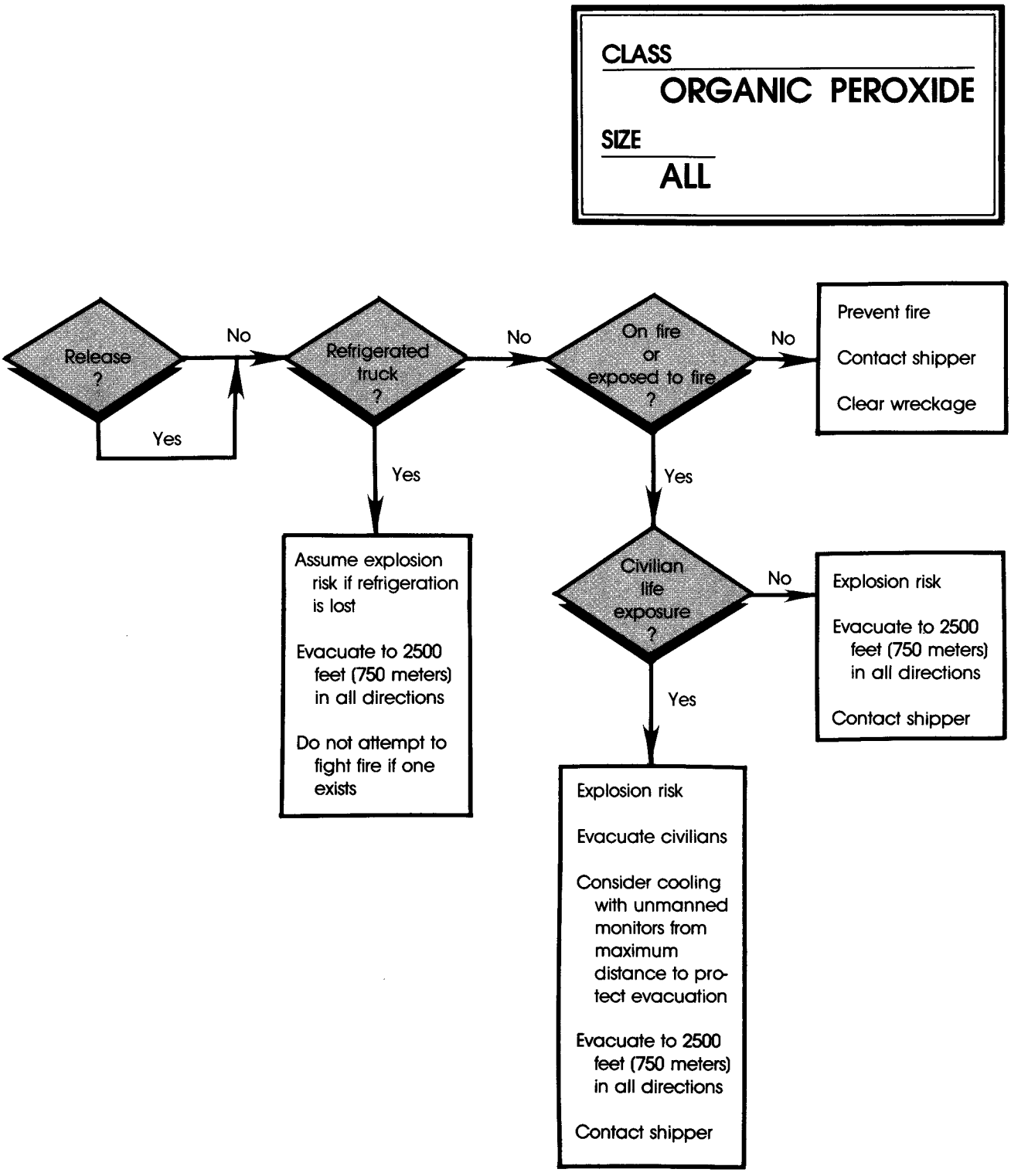
Note

Some organic peroxides and hydroperoxides are very sensitive to acid and may spontaneously react and/or detonate. Small packages of organic peroxides in a fire can also detonate.

PACKAGE SHIPMENTS

In accidents involving organic peroxide, ignition of the chemicals by friction or contact with shipments of acids is possible.

The major accident hazard of organic peroxides is that if heated beyond their transportation temperature they are likely to detonate. Most peroxides are shipped at ambient temperature, but a few must be shipped under refrigeration by motor carrier. Loss of refrigeration can cause fire and/or detonation. If an accident occurs involving a refrigerated truck carrying organic peroxide, contact the shipper immediately for detailed instructions.


CLASS
ORGANIC PEROXIDE
SIZE
ALL
Release ?
No
Refrigerated truck ?
No
On fire or exposed to fire ?
No
Prevent fire
Contact shipper
Clear wreckage
Yes
Yes
Yes
Assume explosion risk if refrigeration is lost
Evacuate to 2500 feet (750 meters) in all directions
Do not attempt to fight fire if one exists
Civilian life exposure ?
No
Explosion risk
Evacuate to 2500 feet (750 meters) in all directions
Contact shipper
Yes
Explosion risk
Evacuate civilians
Consider cooling with unmanned monitors from maximum distance to protect evacuation
Evacuate to 2500 feet (750 meters) in all directions
Contact shipper

POISON A

DOT CLASS

Poison A

DEFINITION

Poisonous gases, vapors, or liquids that are dangerous to life in very small amounts. This class includes:

POISON A (Not A Complete List)

UN #	Name	CAS #
2188	Arsine	7784-42-1
1589	Bromacetone	598-31-2
1955	Chlorpicrin	76-06-2
1582	Chlorpicrin and Methyl Chloride	(Mixture)
1589	Cyanogen Chloride (Content < 0.9% H_2O)	506-77-4
2192	Germane	7782-65-2
1611	Hexaethyltetraphosphate Gas	757-58-4
1613	Hydrocyanic Acid (All Solutions over 5%)	74-90-8
1051	Hydrogen Cyanide	74-90-8
1067	Nitrogen Dioxide (Liquid)	10102-44-0
1660	Nitric Oxide	10102-43-9
1067	Nitrogen Peroxide	10102-44-0
1975	Nitrogen Tetroxide (Content up to 33.2% NO)	10544-72-6
1967	Parathion	56-38-2
1076	Phosgene (Diphosgene)	75-44-5
2199	Phosphine	7803-51-2
1703	Tetraethyldithiophosphate (Compressed Gas)	3689-24-5

BULK SHIPMENTS

Poison gas or liquid may be shipped in single-unit tank cars, tank trucks, or multi-unit tanks commonly called "ton containers." Ton containers are often transported by motor vehicle. Ton containers are not insulated and are not equipped with safety relief devices. Ton containers for chlorine and SO_2 have fusible plugs. If ton containers are not leaking but are endangered by fire, every effort should be made to extinguish the fire around them or to move them away from the fire.

If tanks containing poison gas or liquid are leaking, no one should enter the gas-contaminated area without being equipped with a self-contained breathing apparatus (SCBA). Many Poison A materials can be absorbed through the skin or react with skin. Leakage of these materials requires emergency personnel to wear completely impervious suits in addition to self-contained breathing units. A self-

contained breathing apparatus alone may not give adequate protection. Equipment must meet EPA Level A protection (i.e., SCBA and encapsulating suit). Persons using such apparatus must be qualified and experienced in its use. If leaking tanks are involved in a fire, cooling the tank with streams of water may be effective in reducing internal pressure and rate of leakage. If it is possible to roll the tank so that the point of leakage is at the top, the hazard may be reduced considerably. At least two people should work together, with the second person being in position to assist the first in case of emergency.

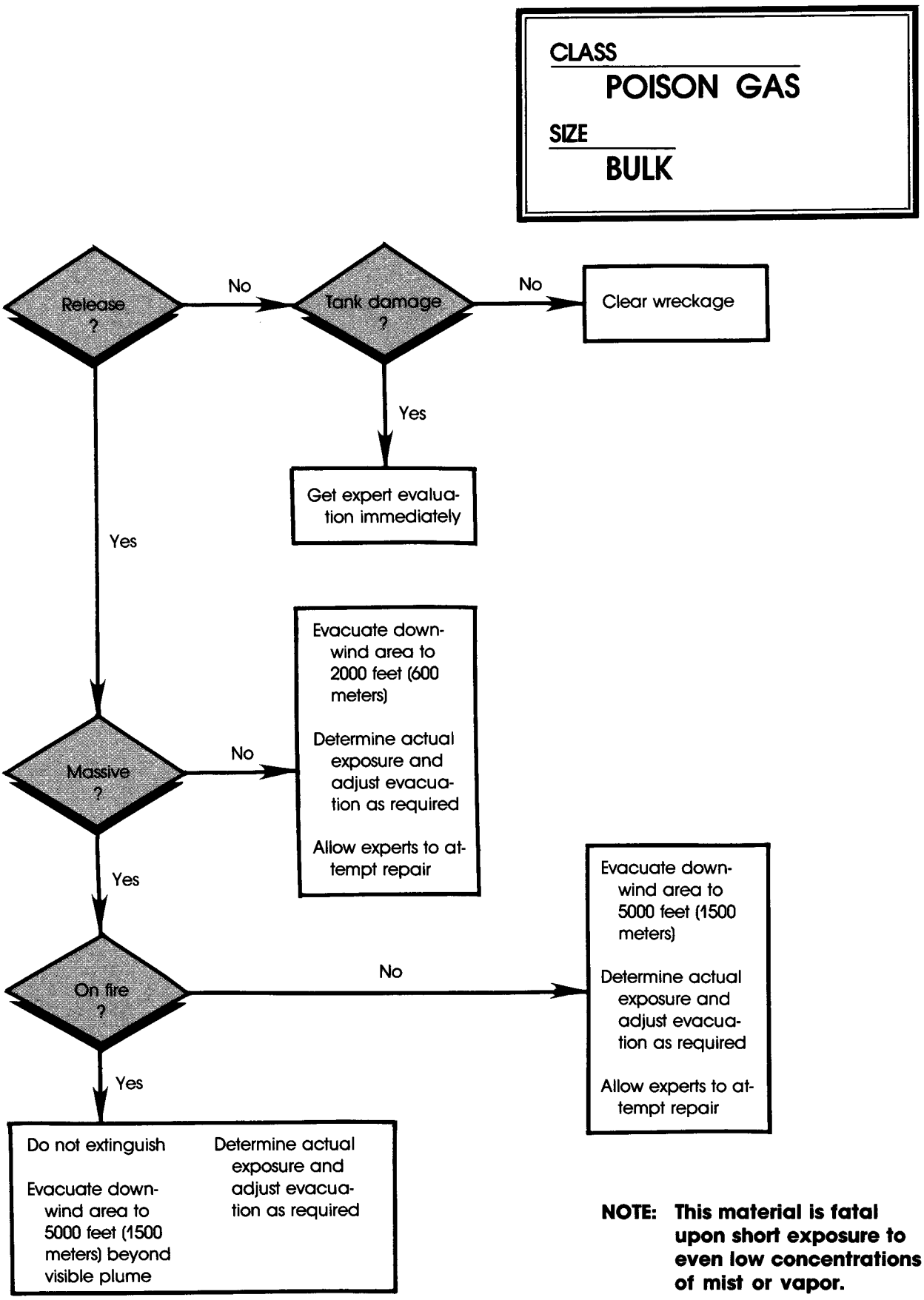
Any person affected by the gas should be removed from the gas area and placed on his back with head and upper back elevated. Call a physician. If clothing is saturated with the gas, remove it to prevent skin irritation and burns. Keep patient warm and quiet. If breathing has ceased, start resuscitation immediately.

If there is leakage of liquid or vapor from a tank of poison gas, all persons must be kept out of any area where the vapors may accumulate. In all cases, immediate assistance should be secured from the shipper or consignee.

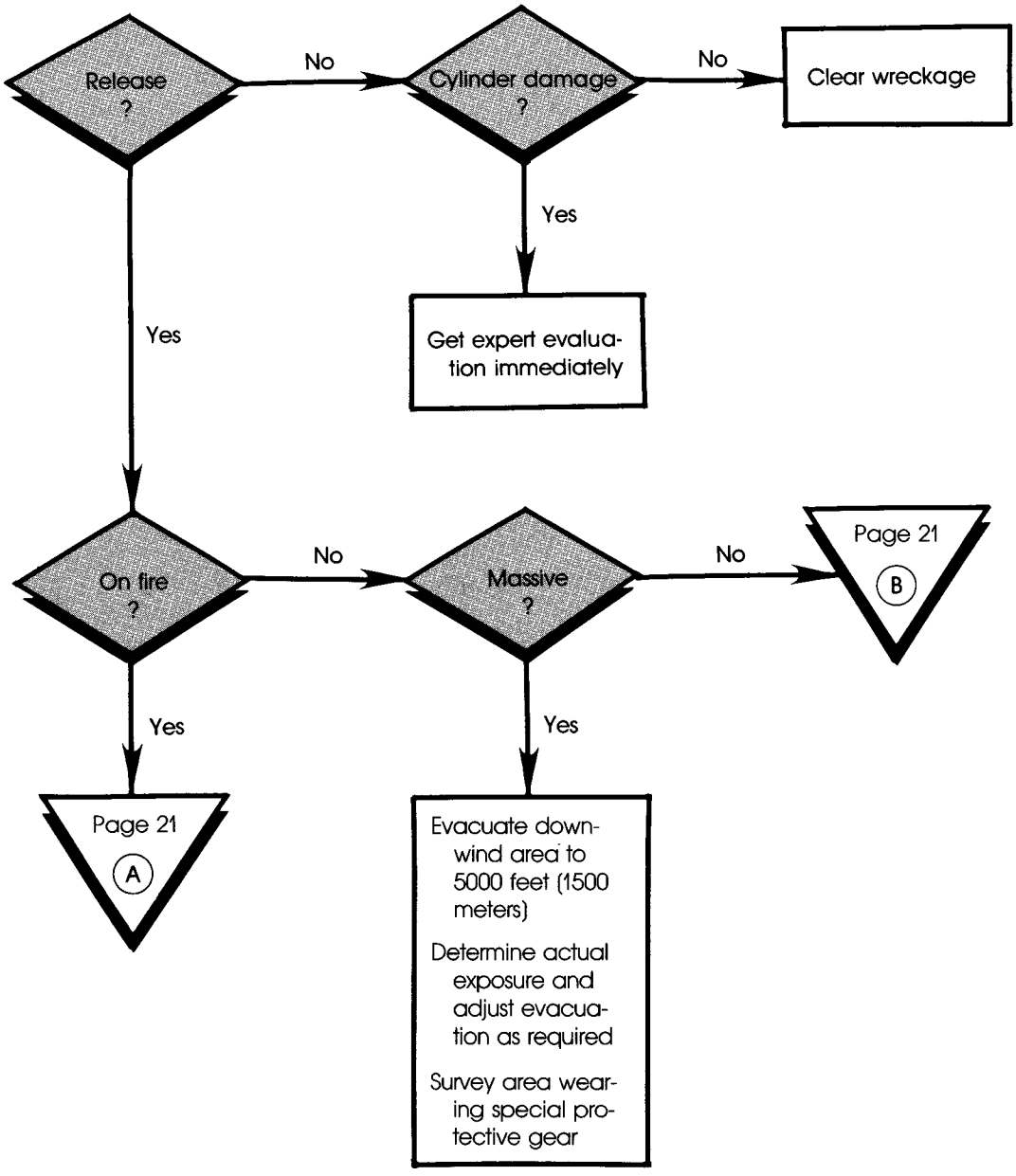
PACKAGE SHIPMENTS

The fumes of "Poison Gas" are deadly. Avoid body contact with liquid or vapor and do not inhale vapor. Even a very small portion of the vapor mixed with air is dangerous to life. Often the leakage is not noticeable and the escaping gas can be neither seen nor smelled. Extreme care is necessary in handling cylinders containing these gases. The shipper or nearest manufacturer of the gas should be called upon to assist in any incident involving these gases.

Because they are not equipped with safety devices, cylinders with "Poison Gas" labels are likely to burst or rupture if involved in a fire or subjected to prolonged intense heat. If fire cannot be brought under immediate control, the area must be evacuated to protect persons from fragments of the cylinders or other effects of the rupture. The heat of the fire will act to disperse any leaked material into the air and spread it downwind.



NOTE: This material is fatal upon short exposure to even low concentrations of mist or vapor.

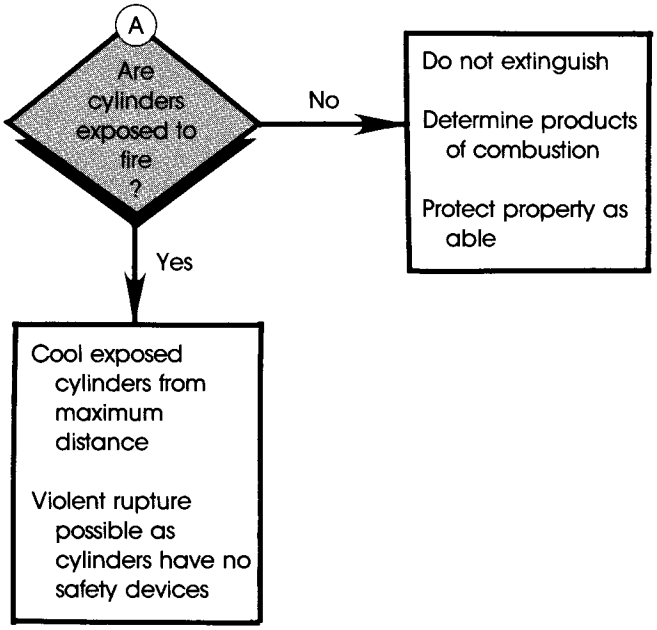

Release ?
No
Cylinder damage ?
No
Clear wreckage
Yes
Get expert evaluation immediately
Yes
On fire ?
No
Massive ?
No
Page 21
B
Yes
Yes
Page 21
A
Evacuate downwind area to 5000 feet (1500 meters)
Determine actual exposure and adjust evacuation as required
Survey area wearing special protective gear

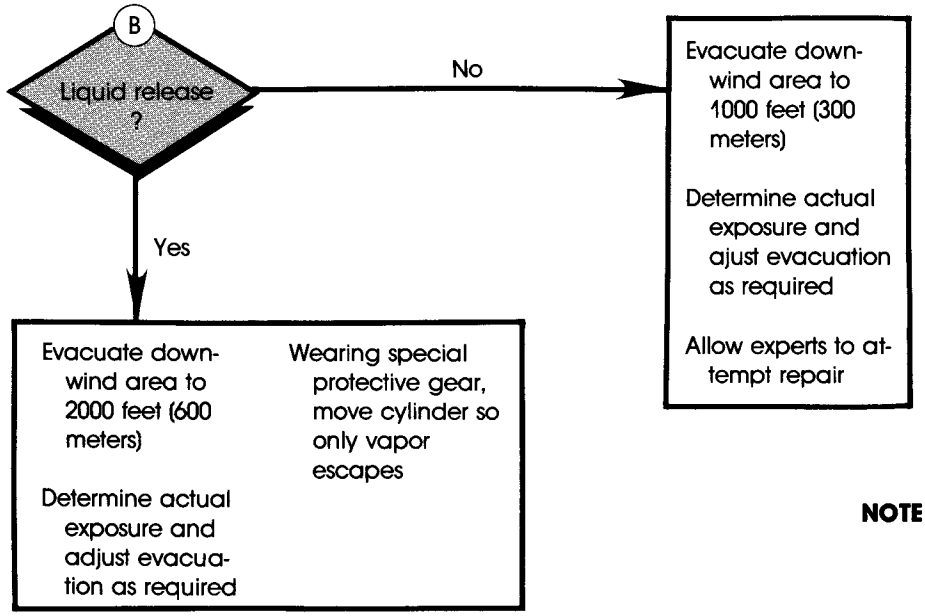
CLASS

POISON GAS

SIZE

CYLINDERS





NOTE: This material is fatal upon short exposure to even low concentrations of mist or vapor.

POISON B

DOT CLASS

Poison B

DEFINITION

Liquid or solid substances, other than Class A poisons or irritating materials, which are known to be so toxic* to man as to afford a hazard to health during transportation or which, in the absence of adequate data on human toxicity, are presumed to be toxic to man because they give positive test results to one of the following tests on laboratory animals.

TEST METHODS

Oral Toxicity

Those which produce death within 48 hours in at least half of a group of ten or more white laboratory rats weighing 200 to 300 grams at a single dose of 50 milligrams or less per kilogram of body weight, when administered orally.

Inhalation Toxicity

Those which produce death within 48 hours in at least half of a group of ten or more white laboratory rats weighing 200 to 300 grams when inhaled continuously for a period of 1 hour or less at a concentration of 2 milligrams or less of vapor, mist, or dust per liter of air, provided such concentration is likely to be encountered by man when the product is used in any reasonable, foreseeable manner.

Skin Absorption Toxicity

Those which produce death within 48 hours in at least half of a group of ten or more rabbits tested at a dosage of 200 milligrams or less per kilogram body weight when administered by continuous contact with the bare skin for 24 hours or less.

General

The foregoing categories shall not apply if the physical characteristics or the probable hazards to humans as shown by experience indicate that the substances will not cause serious sickness or death.

BULK SHIPMENTS

In case of an accident involving leakage of tanks with a "Poison" placard:

1. Isolate the area. Keep spectators away.
2. Contact the shipper, manufacturer, or appropriate agency for further information or assistance.
3. Dig holes or build earthen dikes to prevent the leakage from spreading. Decontamination procedures will depend on the material involved.

*Toxic material: A material which in small concentrations can cause a detrimental physiological change to a living organism.

4. Avoid contact with contents and inhalation of fumes or dusts.
5. Poisons in contact with the body or inhaled may cause serious or fatal reactions. If they contact the body, wash with soap and water. If they can be washed off quickly enough, injury may be prevented. When handling or transferring these materials, wear appropriate protective clothing and breathing apparatus.

> There is no protective clothing adequate for all possible materials and conditions. The chemical manufacturer will typically provide recommendations for the material involved. Certain organic poisons are not effectively removed by use of soap and water. In these cases, contact the manufacturer or CHEMTREC® in addition to the manufacturer of the protective clothing for recommendations.

6. If tanks of poison are leaking, no person should be allowed to enter the contaminated area without appropriate breathing apparatus. Persons using such apparatus must be qualified and experienced in its use. If qualified persons are available, they may attempt to plug the leak or reduce the amount of leakage. Every precaution must be taken to keep leaking liquid from contact with the skin. At least two people should work together, with the second person being in position to assist the first in case of emergency. Any person affected by the vapors should be removed from the area immediately and placed on his back with head and upper back elevated. Call a physician. If clothing has contacted poison, remove it to prevent further poisoning. Keep patient warm and quiet. If breathing has ceased, start resuscitation immediately.
7. If it is necessary to transfer the contents of tanks with a "Poison" placard, call the shipper or the manufacturer for assistance.

> When cleaning up spills or hazardous materials, an absorbent meeting the performance standard in ASTM F 716 is preferred to minimize human contact.

PACKAGE SHIPMENTS

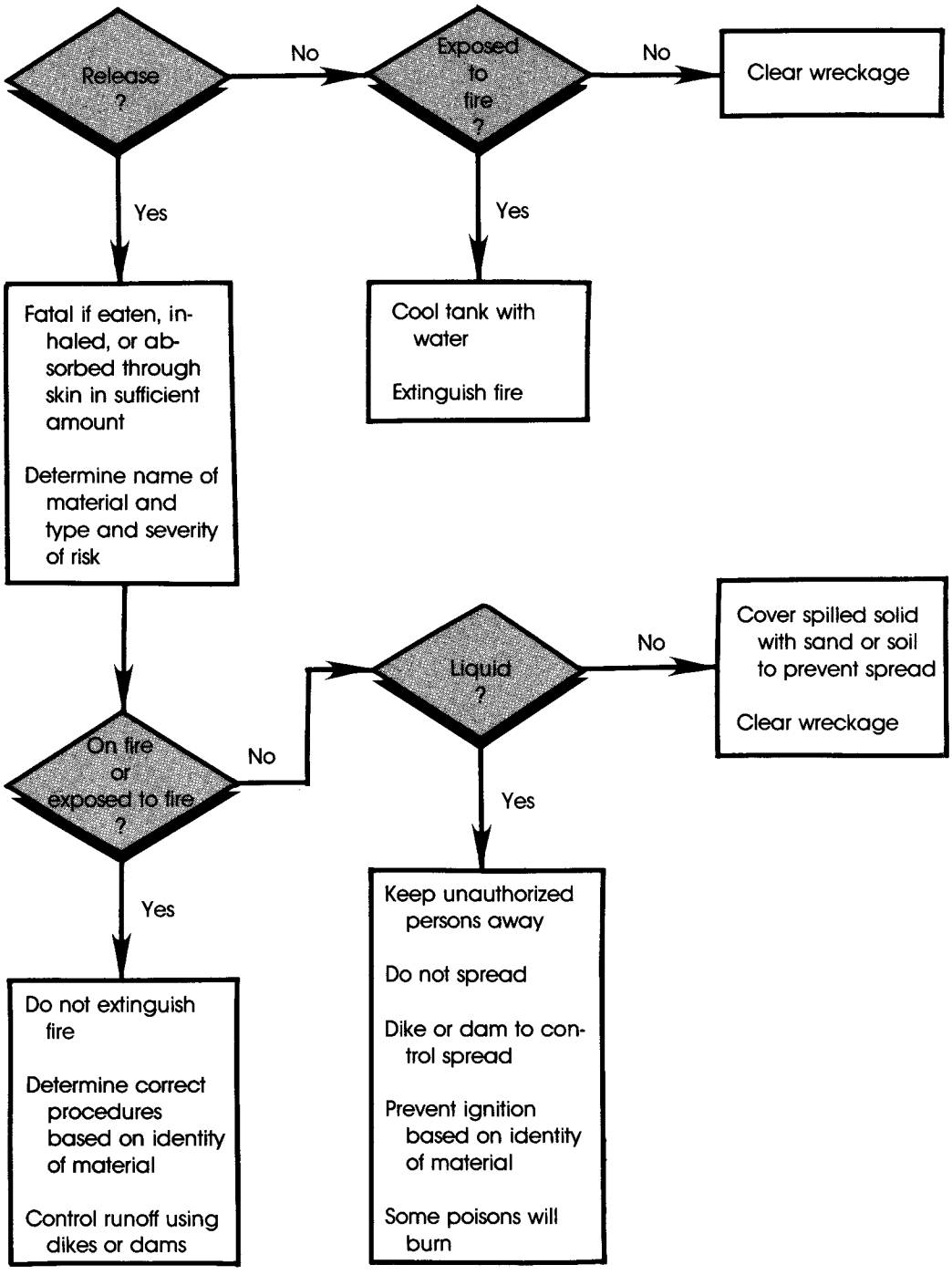
Materials bearing the "Poison" label are chiefly dangerous by direct contact with the body, by contamination of foods and feeds, or by inhalation of dust or vapor. Thorough washing of the hands after handling poisons is necessary even though gloves are used. The vapors of some liquid poisons are offensive and/or dangerous. Spilled materials should be carefully removed and advice as to disposition secured from the shipper. In the case of railroad accidents, the Association of American Railroads, Bureau of Explosives (202/639-2222; 24 hours), should be contacted.

CLASS

POISON B

SIZE

ALL



NONFLAMMABLE GAS

DOT CLASS

Nonflammable Gas

Note

Certain materials designated "Nonflammable" by DOT can actually produce a combustion-type reaction with other materials. While chlorine (UN 1017, CAS 7782-50-5) will not burn in oxygen, it can act like oxygen in contact with combustibles such as natural gas, gasoline, and hydrogen. It not only burns with these materials but can also detonate. This is important in mixed loads. As with oxygen, no oil or combustible material should be used for gaskets or thread lubricants with chlorine.

Ammonia (UN 1005, CAS 7664-41-7) is listed by DOT as a nonflammable gas, but it does have a flammable range of 16 to 25% in air. Ignition is not only possible but has happened with detonation in compressor units and cold storage buildings.

Helium (UN 1046, 1963; CAS 7440-59-7) is truly nonflammable and inert, but it has one unusual hazard. If a helium tank is vented, it will cause the tank to heat up. The heating can cause an increase in pressure, with possible danger.

DEFINITION

A nonflammable material or mixture having an absolute pressure exceeding 40 psi at 70°F (275 kPa at 21°C) or 104 psi at 130°F (717 kPa at 54°C).

RELATED TERMS

Auto-refrigeration

The property of liquefied gas by which the liquid is cooled by release of vapor to the atmosphere.

Cryogenic

A liquefied gas stored below its critical temperature, normally less than −328°F (−200°C).

Liquefied Gas

A gas which under the charged pressure is partially liquid at a temperature of 70°F (21°C).

Nonliquefied Gas

A gas which under the charged pressure is entirely gaseous at a temperature of 70°F (21°C).

Vapor Density

The ratio of the density of a vapor to the density of dry air at designated temperatures and pressures.

Vapor Space

The free area within a container above the liquid level.

BULK SHIPMENTS

In case of an accident involving shipments of nonflammable gas, contact the shipper or the manufacturer of the gas for assistance.

Nonflammable gas may be shipped in single unit tank cars, tank trucks, or in multi-unit tanks commonly called "ton containers." Ton containers are often transported by motor vehicle. Ton containers transporting nonflammable gas are usually equipped with fusible plug safety devices designed to melt in the range of 150 to 220°F (66 to 104°C), releasing the product.

If the tank is leaking, keep ignition sources and spectators away. If there is leakage of liquid, avoid contact with the liquid since it causes frostbite on contact. Whenever possible, shippers should be called upon to assist in stopping leaks. If the gas is water-soluble, water spray may be used to knock down the vapors. If water spray is used, control the runoff as necessary to minimize environmental damage. Adding water to pools of liquefied gas is not generally recommended, because the relative heat of the water will greatly increase the vaporization rate of the material.

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

If the wreckage is on fire, the heat of the fire will tend to vaporize the leaking material and carry the vapors upward. If the tank is not leaking, every effort should be made to extinguish the fire, cool the tank, or move the tank away from the fire. The tank may or may not be insulated, but it is equipped with safety valves designed to prevent excessive pressure.

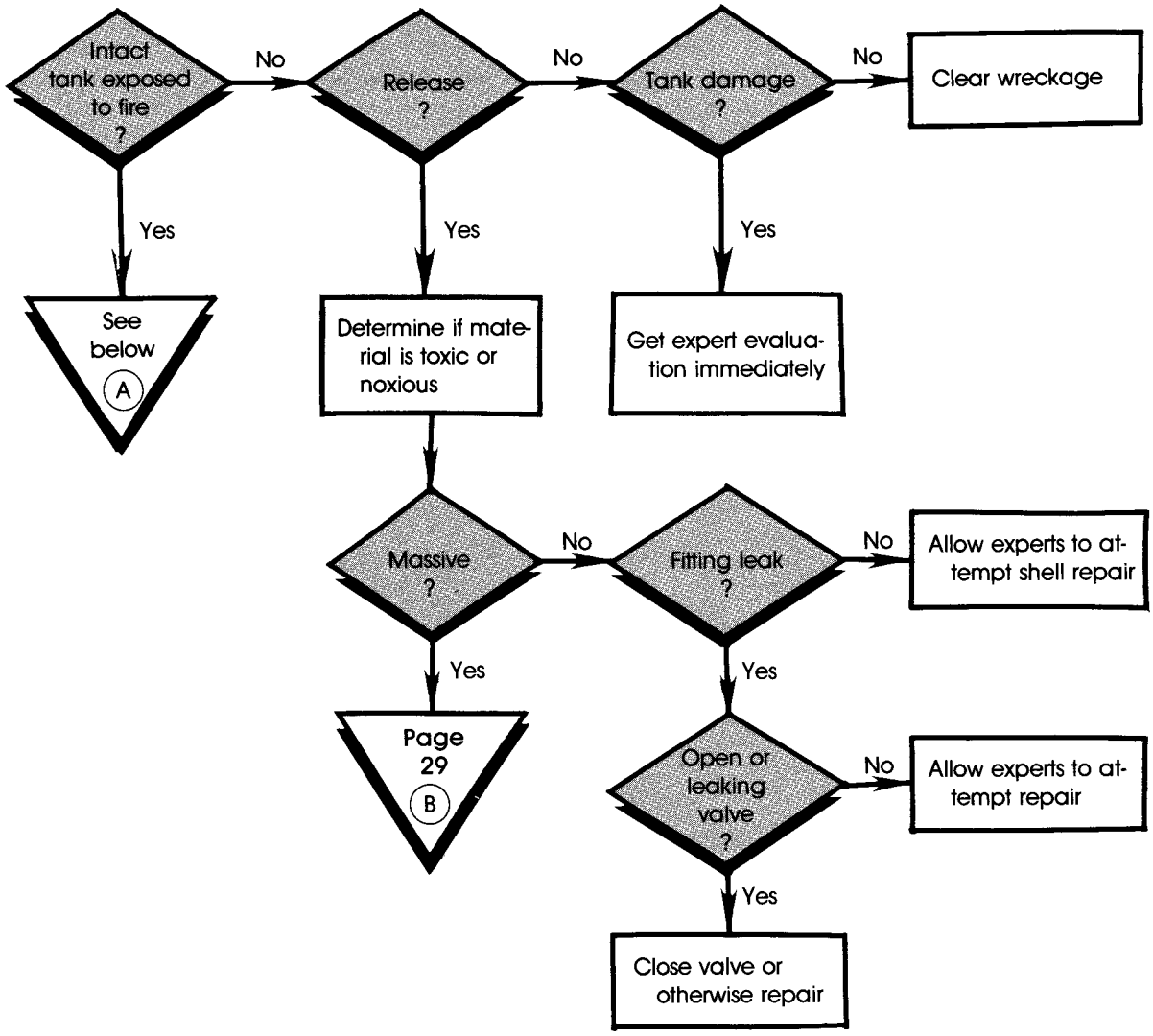
TRANSFER

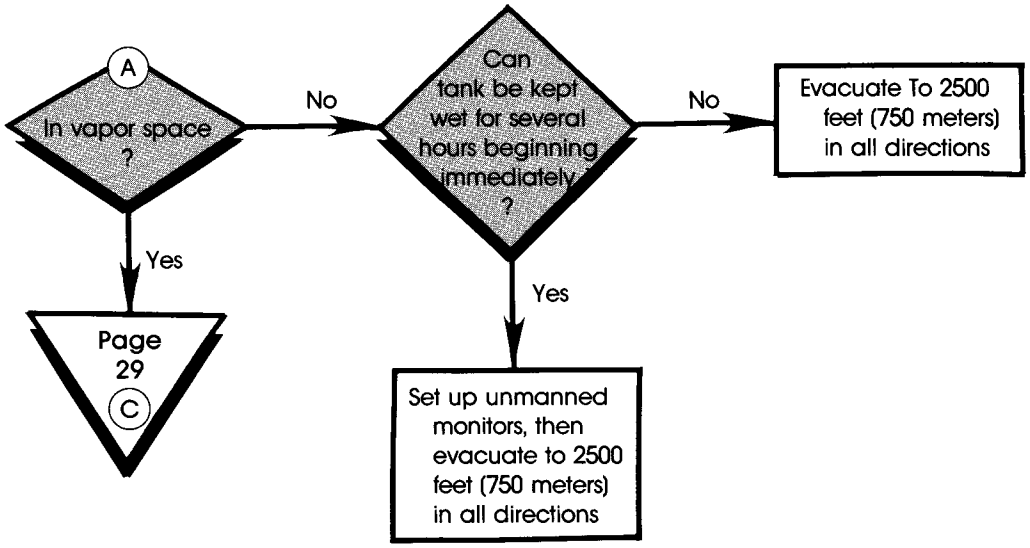
The transfer of nonflammable gases should not be attempted by novices, since this operation calls for special equipment and procedures that should be provided and recommended by the shipper of the car, the manufacturer of the gas, or an experienced contractor.

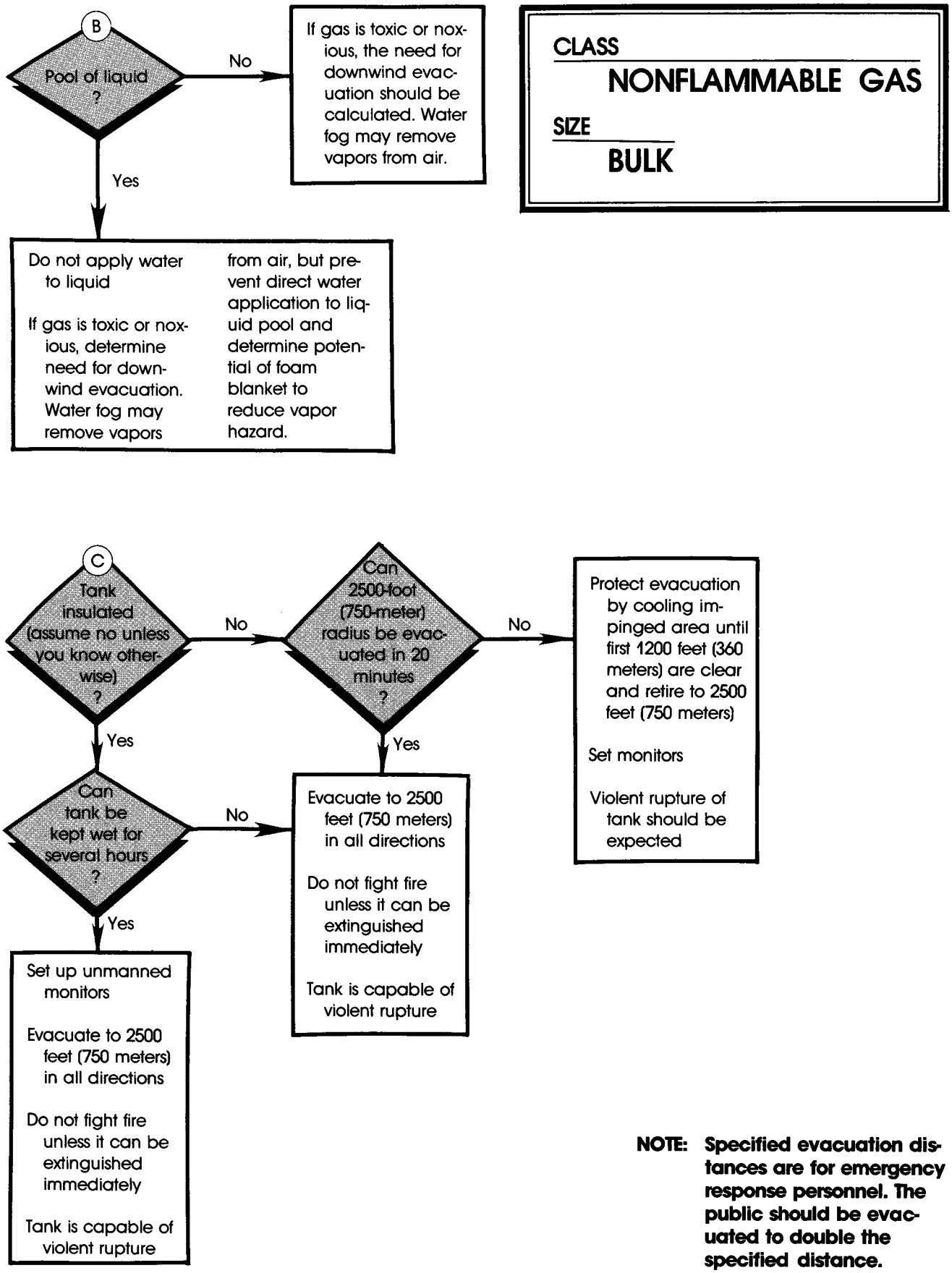
PACKAGE SHIPMENTS

Cylinders of nonflammable gas occasionally develop leaks in transit. It is difficult to stop these leaks, except where gas escapes through a valve accidentally open. If a cylinder containing ammonia, chlorine, or sulfur dioxide is leaking, try to remove the leaking cylinder to an isolated place. Gas cylinders are provided with safety devices to prevent rupture in a fire. In spite of these safety devices, cylinders occasionally burst in fires, throwing metal fragments a distance of several hundred yards (500 yards is about 450 meters). Where fire is known to be in the immediate vicinity of compressed gas cylinders, all unauthorized persons should be kept at least 1500 feet (450 meters) away.

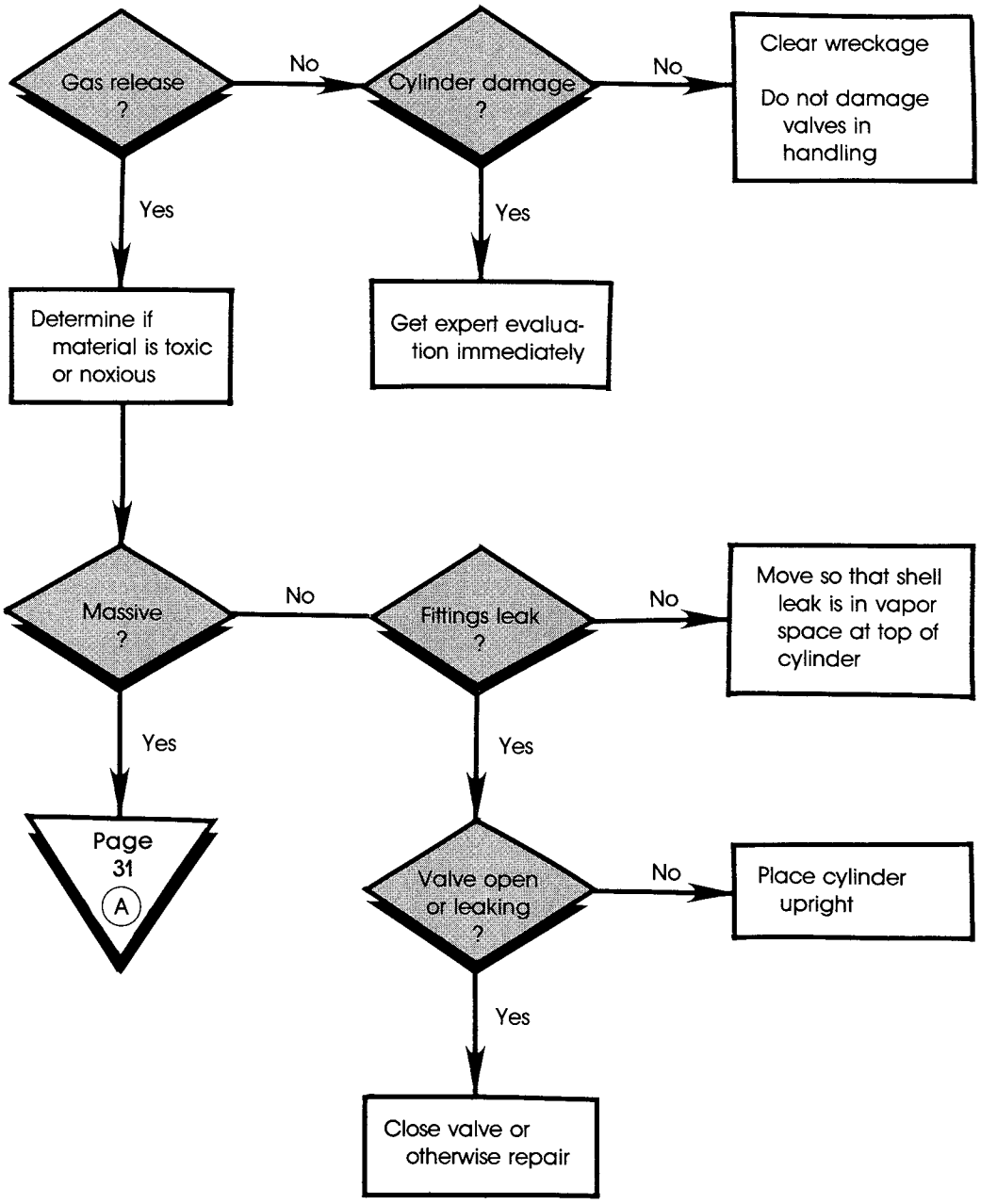
Cylinders of compressed gases that are not leaking should be removed from the wreck if possible, and care must be taken to prevent their being dropped or struck sharply. If valves are not protected, extreme care must be taken that valves are not broken in handling.


Intact tank exposed to fire ?
No
Release ?
No
Tank damage ?
No
Clear wreckage
Yes
Yes
Yes
See below (A)
Determine if material is toxic or noxious
Get expert evaluation immediately
Massive ?
No
Fitting leak ?
No
Allow experts to attempt shell repair
Yes
Yes
Page 29 (B)
Open or leaking valve ?
No
Allow experts to attempt repair
Yes
Close valve or otherwise repair


(A)
In vapor space ?
No
Can tank be kept wet for several hours beginning immediately ?
No
Evacuate To 2500 feet (750 meters) in all directions
Yes
Yes
Page 29 (C)
Set up unmanned monitors, then evacuate to 2500 feet (750 meters) in all directions



NOTE: Specified evacuation distances are for emergency response personnel. The public should be evacuated to double the specified distance.

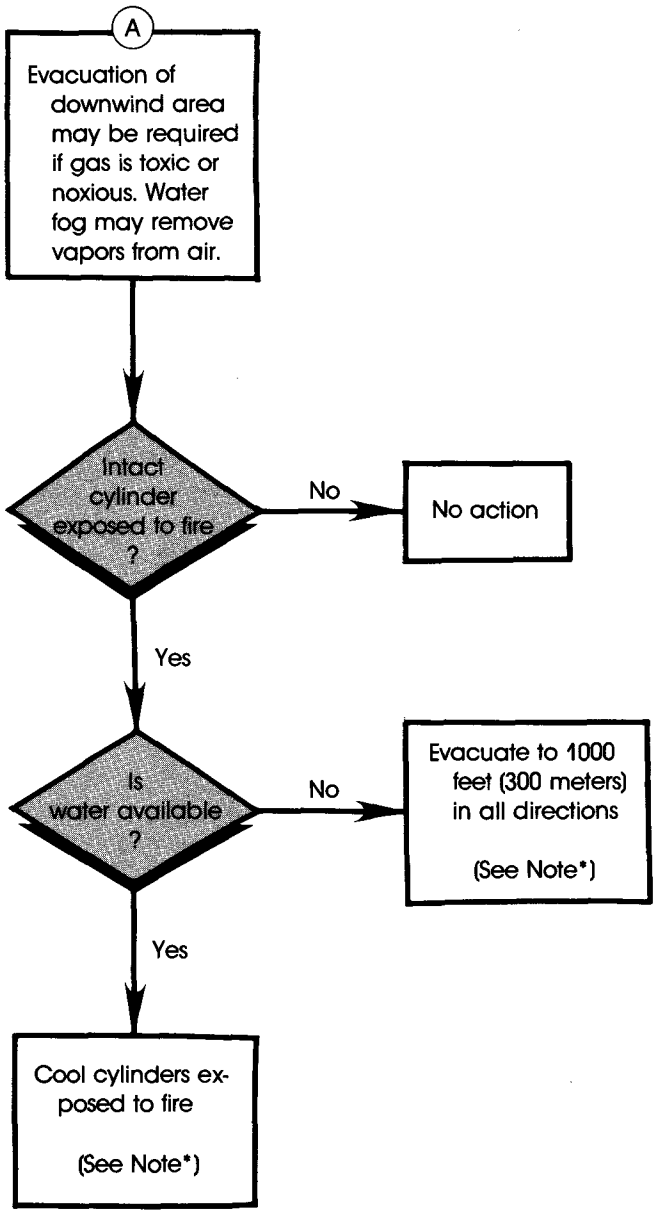

Gas release ?
No
Cylinder damage ?
No
Clear wreckage
Do not damage valves in handling
Yes
Yes
Determine if material is toxic or noxious
Get expert evaluation immediately
Massive ?
No
Fittings leak ?
No
Move so that shell leak is in vapor space at top of cylinder
Yes
Yes
Page 31
A
Valve open or leaking ?
No
Place cylinder upright
Yes
Close valve or otherwise repair

CLASS

NONFLAMMABLE GAS

SIZE

CYLINDERS



***NOTE:** **Cylinders are equipped with safety devices designed to prevent their rupture in a fire. Aerosol cans have no safety device.**

FLAMMABLE GAS, FLAMMABLE LIQUID, COMBUSTIBLE LIQUID

DOT CLASSES

Flammable Gas, Flammable Liquid, Combustible Liquid

Note

These classes form a continuum of decreasing fire hazard in the order given. Fire hazard as used herein refers to the ease with which flammable vapors are evolved and the vapor pressure-temperature characteristics of the material, not to the ability of a material to sustain fire once ignited.

DEFINITIONS

Combustible Liquid

Any liquid that has a flash point at or above 100°F (38°C) and below 200°F (93°C).

Flammable Gas

A flammable material or mixture having a vapor pressure exceeding 40 psi (275 kPa) absolute at 100°F (38°C).

Flammable Liquid

Any liquid having a flash point below 100°F (38°C).

RELATED TERMS

Autoignition Point

The minimum temperature required to initiate combustion of a flammable vapor in the absence of spark or flame.

Auto-refrigeration

The property of liquefied gas by which the liquid is cooled by release of vapor to the atmosphere.

> Hydrogen (UN 1966, CAS 1333-74-0) is a flammable gas that does *not* autorefrigerate. If hydrogen is leaking from a pressure tank, it will cause the tank to heat up. This can cause a dangerous situation from ignition or possible overpressuring of the tank.

Cryogenic

A liquefied gas stored below its critical temperature, normally less than −328°F (−200°C).

Flammable Range The range of vapor concentration in volume percent of gas that forms an ignitable mixture in air.

Flash Point The minimum temperature at which the vapor given off by a liquid within a test vessel forms an ignitable mixture with air.

Gas in Solution A nonliquefied gas dissolved in a solvent. Acetylene (UN 1001, CAS 74-86-2) is transported as a gas in solution.

Liquefied Gas A gas which under pressure is partially liquid at a temperature of 70°F (21°C).

Nonliquefied Gas A gas which under pressure is entirely gaseous at a temperature of 70°F (21°C).

Polymerizable A material which has the ability to react with itself to produce larger molecules with the evolution of heat.

Pyrophoric Liquid Any liquid that ignites spontaneously in dry or moist air at or below 130°F (54°C).

See section beginning on page 59 for more detail on pyrophoric liquids.

Thermally Unstable A material which will rapidly decompose at some elevated temperature, increasing the pressure in a closed container.

Vapor Density Vapor density is the weight of a volume of pure vapor or gas compared to weight of an equal volume of dry air at the same temperature and pressure (NFPA).

BULK SHIPMENTS

Flammable Gas Uninsulated tanks containing flammable gas have been involved in the majority of accidents or fires that have caused loss of life or large property loss.

Fire will occur from gas escaping from tanks either in the course of the accident or immediately after. The *only* condition under which any attempt to extinguish such a fire should be made is if the flow of fuel can be stopped. Stopping the fuel should be attempted only after consultation with experienced hazardous material personnel. As a practical matter, extinguishing the fire is rarely possible.

Uninsulated pressure tanks are likely to rupture violently if flame impinges on the tank. While these tanks all have safety valves to prevent excess pressure build-up, direct flame impingement heats the metal and causes the metal to lose its strength and fail. These failures act like explosions and can produce a fireball up to 900 feet (270 meters) in radius and throw fragments up to 2200 feet (660 meters) in radius.

Fires involving uninsulated flammable gas tanks where one or more intact tanks are suffering direct flame impingement from their own fittings or from another tank are impossible to control. Evacuation to a distance of at least 2500 feet (750 meters) must begin immediately. The time from first flame impingement on the tank or on the vapor space until rupture is usually 20 to 30 minutes. These fires cannot be successfully fought long enough to allow the contents to burn out. The only time any attempt to control these fires should be considered is to protect an evacuation, and this option entails a very high risk even if large quantities of water can be applied quickly to the affected tank.

If a flammable gas tank is burning at the safety valve, at a hole in the tank, under the access cover, or at the discharge valves, and flames are not impinging on it or another car, there is relatively little risk of violent rupture. Under such conditions the tank should be allowed to burn itself out. If the fire is extinguished, the escaping flammable vapors will spread over a large area; they can be ignited by any available source of ignition, causing a sudden violent flash fire that will do great damage. It is safer to let the gas burn at the point of leakage.

Tanks that are punctured and burn out often have enough vapor left in them so that an explosive mixture will exist in the tank. The tank must be purged and/or inerted when the fire goes out.

Railroad tank cars transporting flammable gas are required to be thermally protected. Limited experience with thermally protected flammable gas tank cars suggests that they are not as likely to rupture under fire conditions as are non-protected tanks, but there is not enough experience to regard them as able to withstand all fire conditions without rupture.

Flammable gases shipped in single unit tanks are all shipped as liquefied gas. This is important to know because liquefied gases will vaporize under normal conditions and produce 200 to 600 volumes of vapor for every one volume of liquid.

Another important consideration is the flammable range, which varies for each material. Some vapors are flammable in mixtures as lean as 2% vapor in air; restated, vapor diluted by 49 volumes of air to 1 volume of vapor could be flammable.

If liquid or vapor is released, all sources of ignition must be kept out of any area where the vapor concentration is at or above the lower explosive limit (LEL). Combustible gas indicators are available to check the LEL. If tanks are opened in an accident, all people and power equipment should be kept at least 3000 feet (900 meters) away until the boundary of the LEL is known. Continual monitoring of the LEL boundary is required until discharge is stopped and vapors have dispersed. Addition of water to pools of liquefied gas is not generally recommended, because the relative heat of the water will greatly increase the vaporization rate of the material. See ASTM F 1129.

Flammable vapors that cannot be confined may ignite upon contact with a spark or flame and flash back to the opening from which the vapor originated. After such a flash of fire, the vapors will burn above the surface of the liquid or at the point of discharge.

Take these steps to prevent setting vapors on fire:

1. Extinguish all fires and smoking materials in the vicinity. When lights are necessary, use only permissible electric flashlights. Keep internal combustion engines out of the vapor cloud. Use a combustible gas indicator to determine the boundary of the LEL of a flammable vapor cloud.
2. Keep all unauthorized persons away.
3. If possible, dig holes or trenches or build earthen dikes in the path of flowing liquid to reduce the area of liquid surface from which vapor 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 may travel a considerable distance with the wind; in addition, vapors may spread in the upwind and crosswind directions. Dispersion will be aided by using streams of water to break up vapor streams at the point of leakage from the car. Water fog will tend to disperse vapors in still air.
4. Do not permit flammable gas or fluids to drain into sewers or drains, since vapor rising from them may ignite at some point far distant from the spill, causing serious threat to life and property damage. Do not use detergents or

dispersants to wash these materials into sewers or drains. In some cases, detergents and dispersants can actually increase the vapor hazard. Do not permit liquid to drain into water sources or on the ground. Water sources thus contaminated may have environmental damage.

5. Watch all tanks from a safe distance. Locate all leaks and stop them if possible. See ASTM F 1127. Be aware of the mechanical damage possible from large quantities of diked water runoff.
6. Wrecking operations or transfer of contents of tanks of flammable gas should not be attempted until all vapors in that vicinity are dispersed. Verify safety of the atmosphere around the tank by use of a combustible gas indicator. Cutting torches or tools must not be used in or around empty or loaded tanks. Assure that all tanks involved in a transfer operation are properly grounded and bonded. Proper sorbents should be on hand at the start of transfer operations to immobilize a spill. See ASTM F 716 and ASTM F 726.
7. If leaks are expected in handling, transfer contents to another container. Transfer of flammable gas tanks involved in accidents should not be undertaken by novices. Contact the shipper, consignee, or experienced contractor for transfer of lading.

Flammable and Combustible Liquid

When tanks of flammable liquid are leaking, fire may occur as they contain liquids with a flash point below 100°F (38°C).

The flash point of a liquid is the lowest temperature at which the vapor given off by the liquid will mix with air above the surface of the liquid to form an ignitable mixture. It is not the liquid that burns but the vapor. The possibility of ignition is greatest for liquids having low flash points. The lower the flash point, the greater the probability that the temperature of the liquid or the atmospheric temperature will be materially higher than the flash point of the liquid. The higher the temperature, the greater the amount of vapor formed and the greater the hazard. Quite frequently, when leakage occurs in an accident ignition is caused instantly by friction sparks.

Combustible liquids have flash points between 100 and 200°F (38 and 93°C). They are more difficult to set afire than flammable liquids, but once ignited burn very well. On hot days, lower-flash-point combustible liquids may evolve enough vapor to require handling as a flammable liquid.

If fire occurs, immediately:

1. Rescue injured persons.
2. Pull away any other vehicles that are movable and not burning.
3. Dig holes or build earthen dikes in the path of burning liquid to limit the fire area and thus protect adjacent property against fire damage.
4. Control fire to protect property but do not extinguish it until all spilled material has burned. If exposures require fire be controlled, consider the use of foam or water fog to reduce intensity. An extinguished fire will create a flammable vapor hazard. Water streams are likely to float the liquid and spread the fire.
5. Watch all tanks in the fire for evidence of bulging or the appearance of red "hot spots" in the metal, which are an indication that the strength of the steel at such spots is being reduced by heat to a point where it cannot hold the pressure maintained in the tank. The hot spots are caused by a flame playing against the shell of a tank car. Keep all persons away because, if the metal fails, a stream of burning liquid or vapor may be projected many feet. Water streams applied at point of flame impingement will prevent development of hot spots if sufficient water can be applied. If water streams are used to cool tanks while hazardous materials are in the area, runoff should be controlled to limit environmental damage. Be aware of the possible mechanical damage from large quantities of diked water runoff if the dike is breached.

Do not puncture or rupture the shell of a tank involved in a fire. Puncture or rupture will increase the seriousness of the situation, since any opening made in a tank will liberate more flammable liquid and extend the fire. The safety valves on tank vehicles are designed to limit internal pressure to much less than the designed bursting pressure of the tank, provided the valves are not buried or so obstructed that they cannot open. When a tank is so positioned that the safety valves are buried, if it is safe to do so an effort should be made to roll it into a position where the valves are able to function properly.

When vapors are burning at the safety valves do not extinguish the flame; otherwise the leakage from the valves may spread over a large area and ignite, causing a sudden violent flash fire that may do great damage. It is safer to let the vapor burn at the valves or point of leakage.

If fire does not occur immediately in an accident, the hazard of a leak of flammable liquid is *greater* than when fire occurs immediately. The vapor given off by flammable liquid will spread over a large area and will travel faster, especially with the wind, than the liquid will flow. Vapor cannot be confined, will ignite upon contact with any spark or flame, and will flash back to the liquid surface from which the vapor originated. After such a flash of fire the vapor burns above the surface of the liquid.

Guard against the serious hazards that exist even when the leakage is not on fire:

1. Extinguish all fires and smoking materials in the vicinity. When lights are necessary, use only permissible electric flashlights. Keep internal combustion engines out of the flammable vapor area. Use a combustible gas indicator to determine the boundary of the LEL of the flammable vapors.
2. Keep all unauthorized persons out of the area.
3. Dig holes or trenches or build earthen dikes in the path of a flowing liquid surface from which vapor can be given off.
4. Cover the liquid with sand, dirt, or appropriate foam to blanket the surface and reduce the rate of evaporation. The vapor of most flammable liquids is heavier than air and forms a layer along the ground which mixes slowly with the air. The mixing with air is increased by wind. The vapor flows along the ground following the slope of the ground and settles in low places sheltered from the wind. It will not drift or flow against the wind but may travel a considerable distance with the wind. Vapors can be dispersed by spraying with water as a fog. See ASTM F 1127.
5. Do not permit liquid to drain into sewers, since vapor arising from the liquid may ignite at some point far distant from the leak and cause serious damage to life or property. Do not permit liquid to drain into water sources. Water thus contaminated may cause environmental harm. Do not use detergents or dispersants, since they may enhance vapor release in sewers and cause excessive penetration into soil.
6. Locate all leaks and stop them if possible. Nonmetallic plugs are useful for this purpose.
7. Wrecking operations or transfer of contents of tanks of flammable liquid should not be attempted until all vapors are dispersed. Cutting torches must not be used on tanks either empty or loaded. Certain liquids that do not have a flash point do have explosive limits in vapor/air mixtures. Life has been lost! Many liquids regarded as safe under ordinary conditions and transported as combustible or nonregulated materials should be treated as dangerous in an accident. An empty or partially empty tank with or without placards is very likely to contain a vapor-air mixture that may ignite. Fumes in any empty tank should be considered as injurious to a person entering it. An empty tank should not be entered before it has been steam cleaned and checked for residual vapors.

No tank or pit should be entered without a check of the atmosphere and/or a self-contained breathing apparatus. Cleaned tanks that have been closed have had sufficient rusting to deplete the oxygen and cause loss of life. Always have air supply when entering a tank or pit. In all cases, tank entry should be considered a very dangerous procedure. See OSHA Confined Space Entry Procedure, 29 CFR-1910. When using cutting torches, care must be exercised to avoid contact with leakage or ground saturated with even such materials as lubricating oils, asphalts, other petroleum products, vegetable oils, and animal fats. They can be ignited and may burn fiercely.

8. Move to safety the least damaged vehicles. Avoid sudden shocks or jars that might produce sparks or friction. No unnecessary attempt should be made to move a damaged tank from which flammable liquid is leaking.
9. As a last resort, a tank may be moved by dragging, preferably on a bed of foam. All persons should be kept at a safe distance, determined by combustible gas detector measurements. When leaks are expected in handling, empty the tank first by transfer of contents and make inert with nitrogen or other non-combustible gas.

PACKAGE SHIPMENTS

Flammable Gas

Cylinders of flammable gas occasionally develop leaks in transit. It is difficult to stop these leaks except where gas escapes through a valve accidentally open. A leaking cylinder of flammable gas should be removed to an open space well away from possible sources of ignition and left in this location until the contents have escaped. Flammable gas cylinders are provided with safety devices to prevent rupture in case they are exposed to fire. In spite of these safety devices the cylinders occasionally burst in fires and throw pieces of the cylinder for a distance of several hundred yards. Where fire is known to be in the immediate vicinity of compressed gas cylinders, all unauthorized persons should be kept at least 1500 feet (450 meters) away.

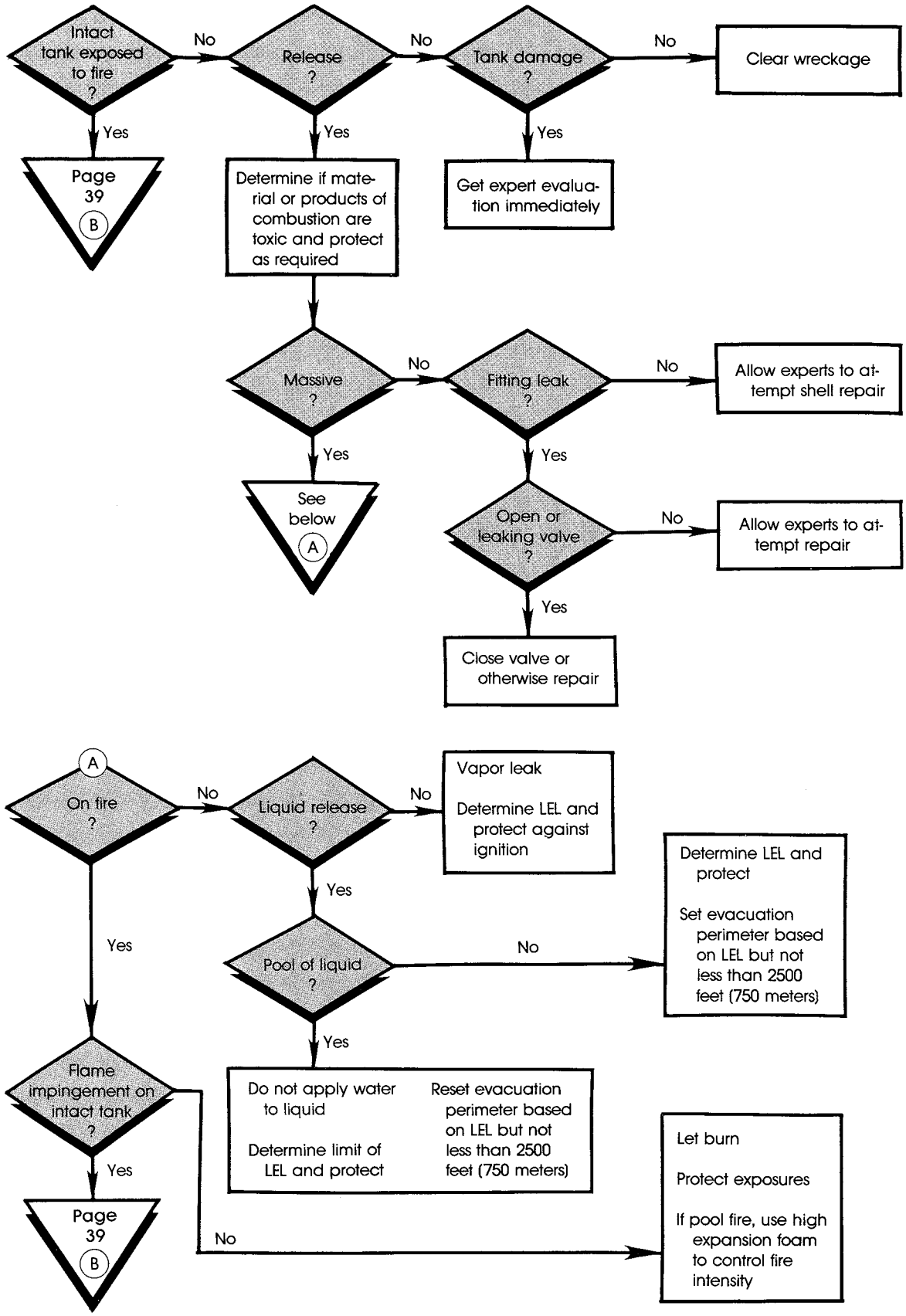
Cylinders of compressed gases that are not leaking should be removed from the wreck if possible. Care must be taken to prevent their being dropped or struck sharply. If valves are not protected, extreme care must be taken that valves are not broken or damaged during handling.

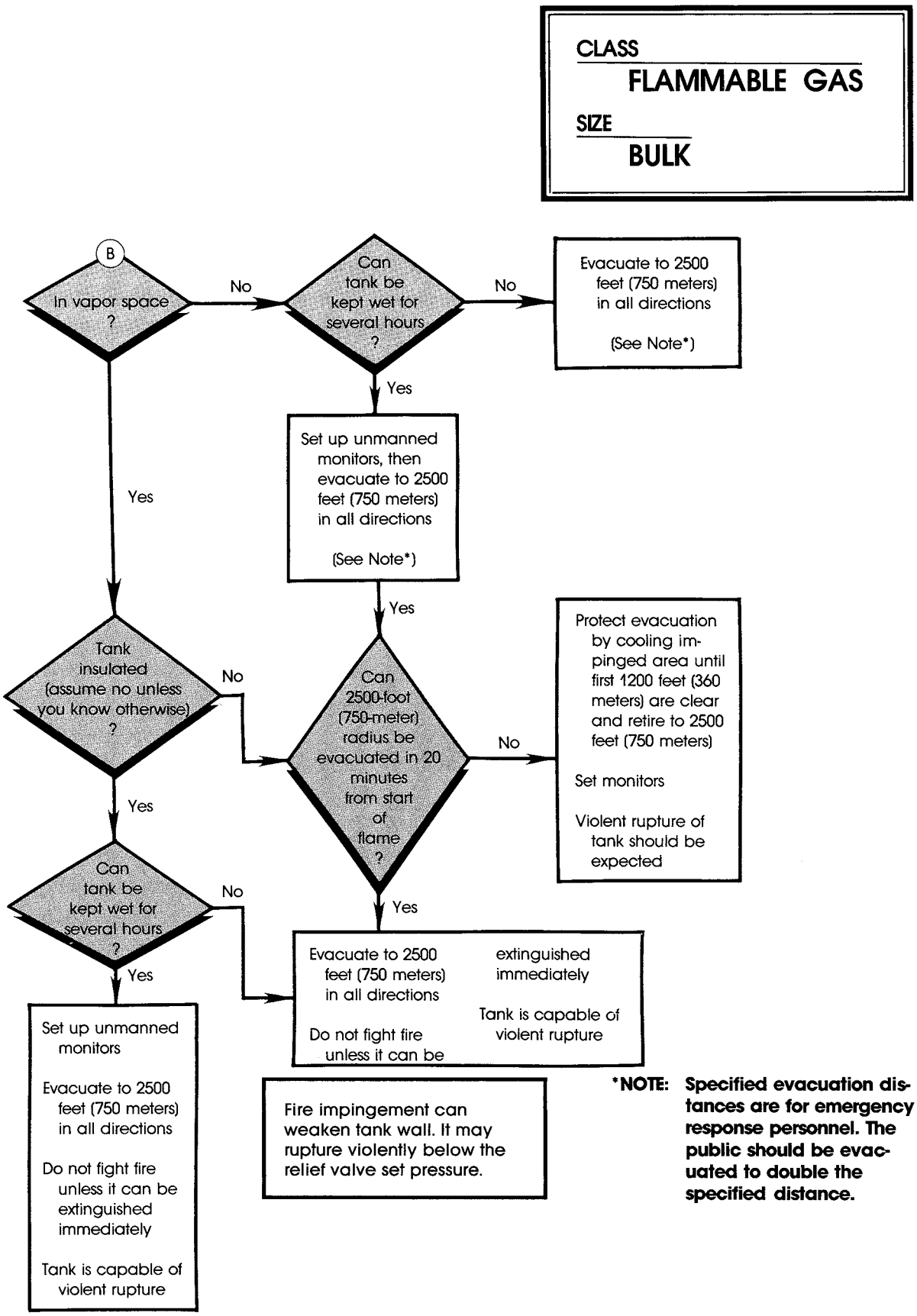
Flammable Liquid

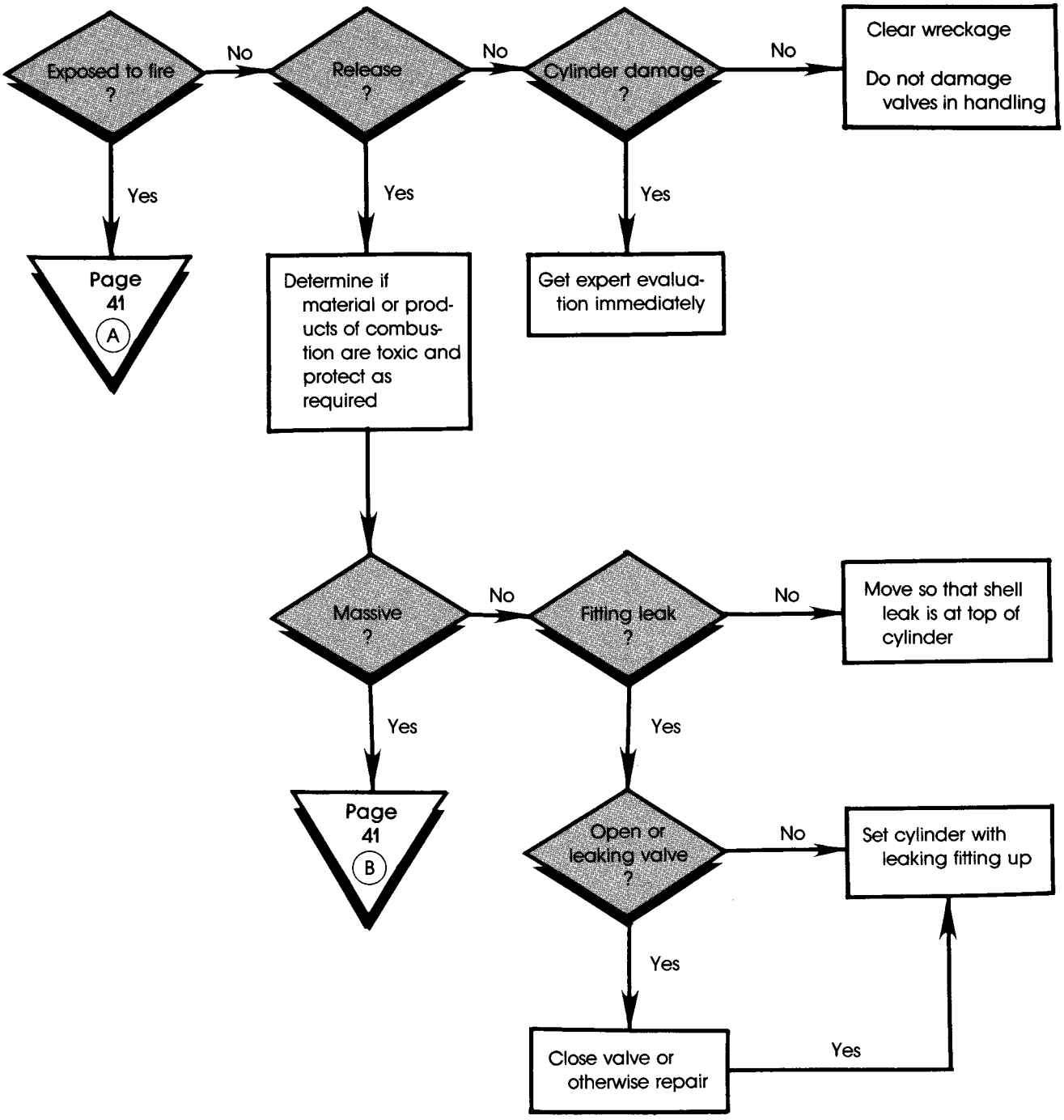
In case of an accident involving a vehicle containing packages of flammable liquids, it should be assumed that packages are broken and that leakage has occurred and may cause fire. The presence of vapors will generally be indicated by characteristic odors. In a railroad incident as much of the train as possible should be removed to a place of safety. A vehicle containing packages of flammable liquids should be opened for ventilation, and packages with flammable liquid labels should be carefully removed to a safe place. When leakage is continuous, ventilation will not remove the danger. Flammable liquids spilled from broken packages should be well covered with dry earth or preferably picked up with proper absorbents. See ASTM F 716.

Combustible Liquid

Shipping papers covering shipments of combustible liquids in packages of less than 110 gallon (415 liter) capacity will not indicate that the liquid is combustible. Packages of less than 110 gallons of combustible liquid will not be labeled. The shipper of any liquid in packages less than 110 gallons should be contacted to determine hazards if there is any reason to suspect that the liquid is combustible.


Intact tank exposed to fire ?
No
Release ?
No
Tank damage ?
No
Clear wreckage
Yes
Page 39 B
Yes
Determine if material or products of combustion are toxic and protect as required
Yes
Get expert evaluation immediately
Massive ?
No
Fitting leak ?
No
Allow experts to attempt shell repair
Yes
See below A
Yes
Open or leaking valve ?
No
Allow experts to attempt repair
Yes
Close valve or otherwise repair
A
On fire ?
No
Liquid release ?
No
Vapor leak
Determine LEL and protect against ignition
Yes
Yes
Pool of liquid ?
No
Determine LEL and protect
Set evacuation perimeter based on LEL but not less than 2500 feet (750 meters)
Yes
Flame impingement on intact tank ?
Yes
Page 39 B
Do not apply water to liquid
Determine limit of LEL and protect
Reset evacuation perimeter based on LEL but not less than 2500 feet (750 meters)
No
Let burn
Protect exposures
If pool fire, use high expansion foam to control fire intensity


CLASS
FLAMMABLE GAS
SIZE
BULK
B
In vapor space ?
No
Can tank be kept wet for several hours ?
No
Evacuate to 2500 feet (750 meters) in all directions
(See Note*)
Yes
Set up unmanned monitors, then evacuate to 2500 feet (750 meters) in all directions
(See Note*)
Yes
Yes
Tank insulated (assume no unless you know otherwise) ?
No
Can 2500-foot (750-meter) radius be evacuated in 20 minutes from start of flame ?
No
Protect evacuation by cooling impinged area until first 1200 feet (360 meters) are clear and retire to 2500 feet (750 meters)
Set monitors
Violent rupture of tank should be expected
Yes
Yes
Can tank be kept wet for several hours ?
No
Yes
Evacuate to 2500 feet (750 meters) in all directions
Do not fight fire unless it can be extinguished immediately
Tank is capable of violent rupture
Set up unmanned monitors
Evacuate to 2500 feet (750 meters) in all directions
Do not fight fire unless it can be extinguished immediately
Tank is capable of violent rupture
Fire impingement can weaken tank wall. It may rupture violently below the relief valve set pressure.
*NOTE: Specified evacuation distances are for emergency response personnel. The public should be evacuated to double the specified distance.

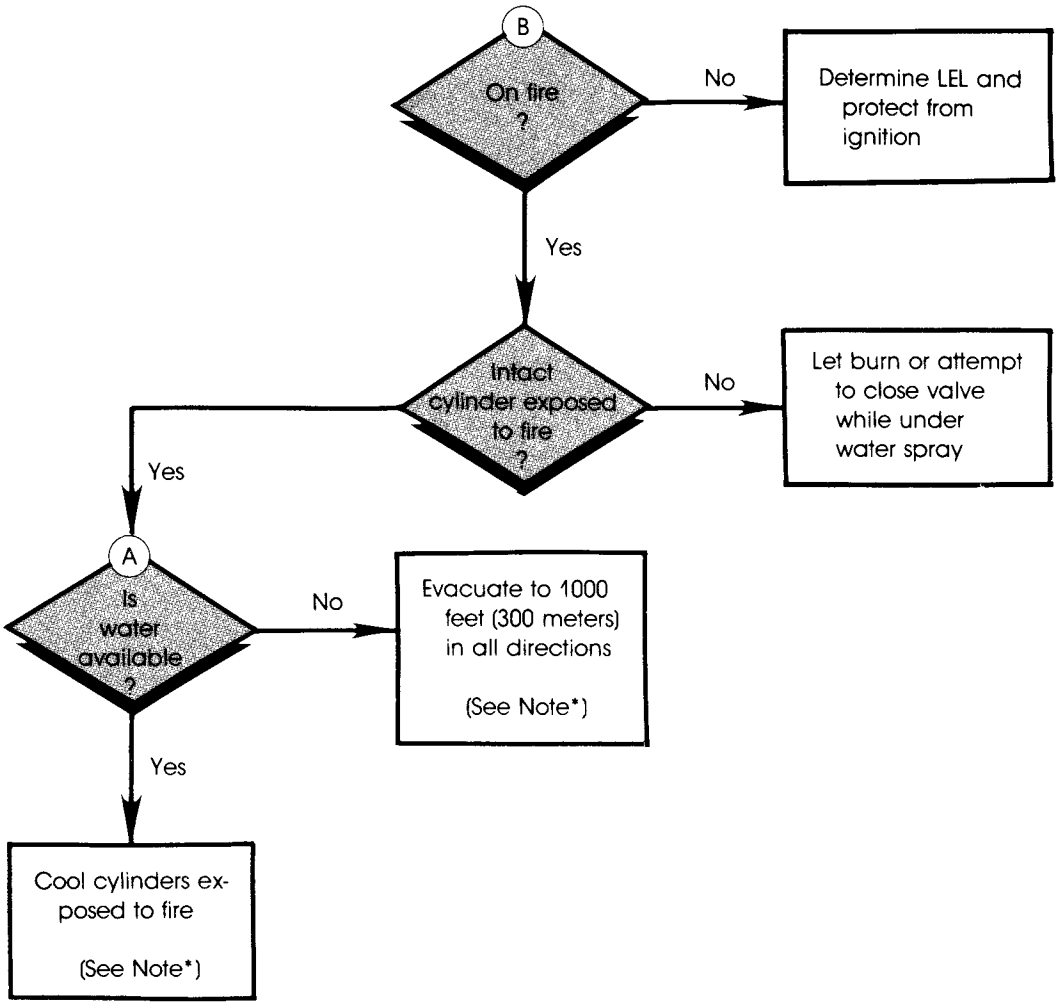

Exposed to fire ?
No
Release ?
No
Cylinder damage ?
No
Clear wreckage
Do not damage valves in handling
Yes
Yes
Yes
Page 41 (A)
Determine if material or products of combustion are toxic and protect as required
Get expert evaluation immediately
Massive ?
No
Fitting leak ?
No
Move so that shell leak is at top of cylinder
Yes
Yes
Page 41 (B)
Open or leaking valve ?
No
Set cylinder with leaking fitting up
Yes
Close valve or otherwise repair
Yes

CLASS

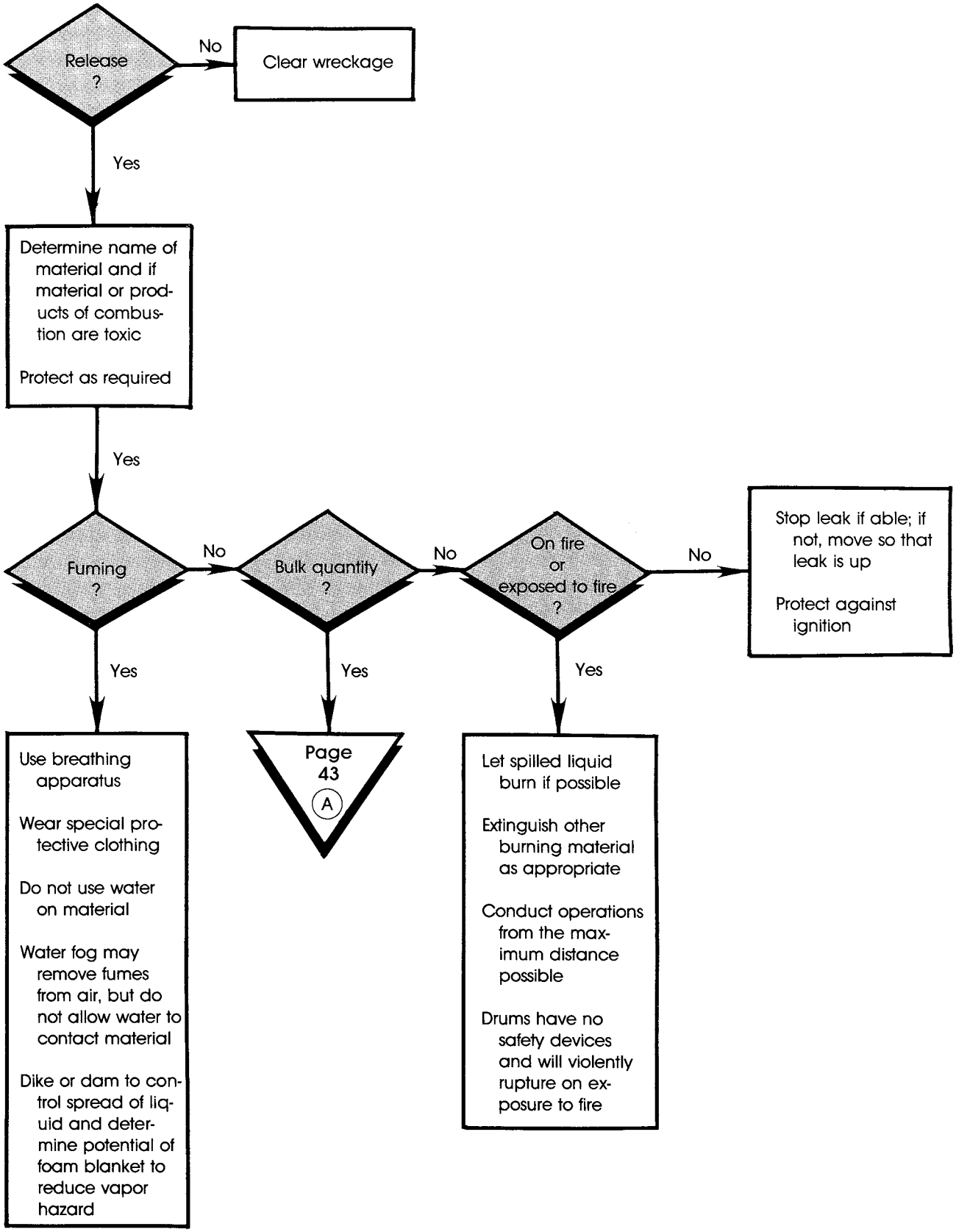
FLAMMABLE GAS

SIZE

PACKAGE (CYLINDERS)

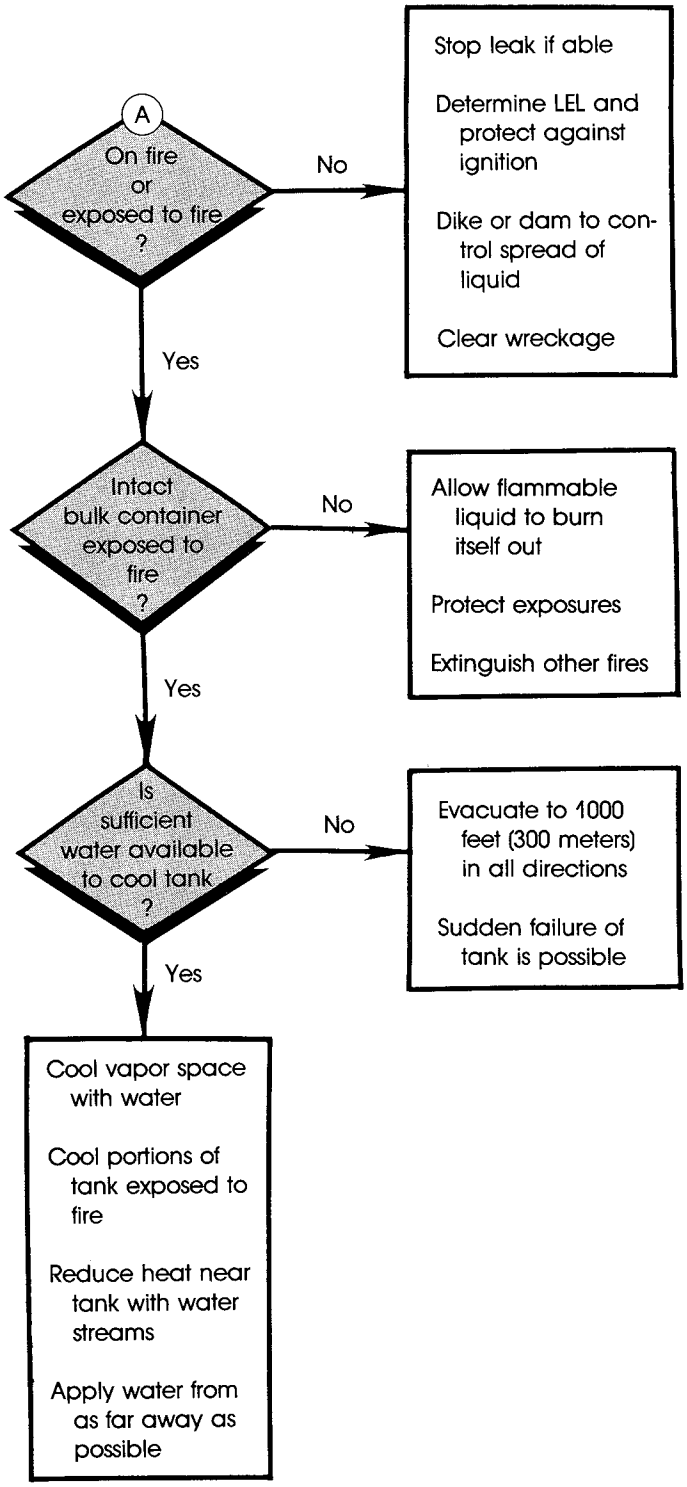


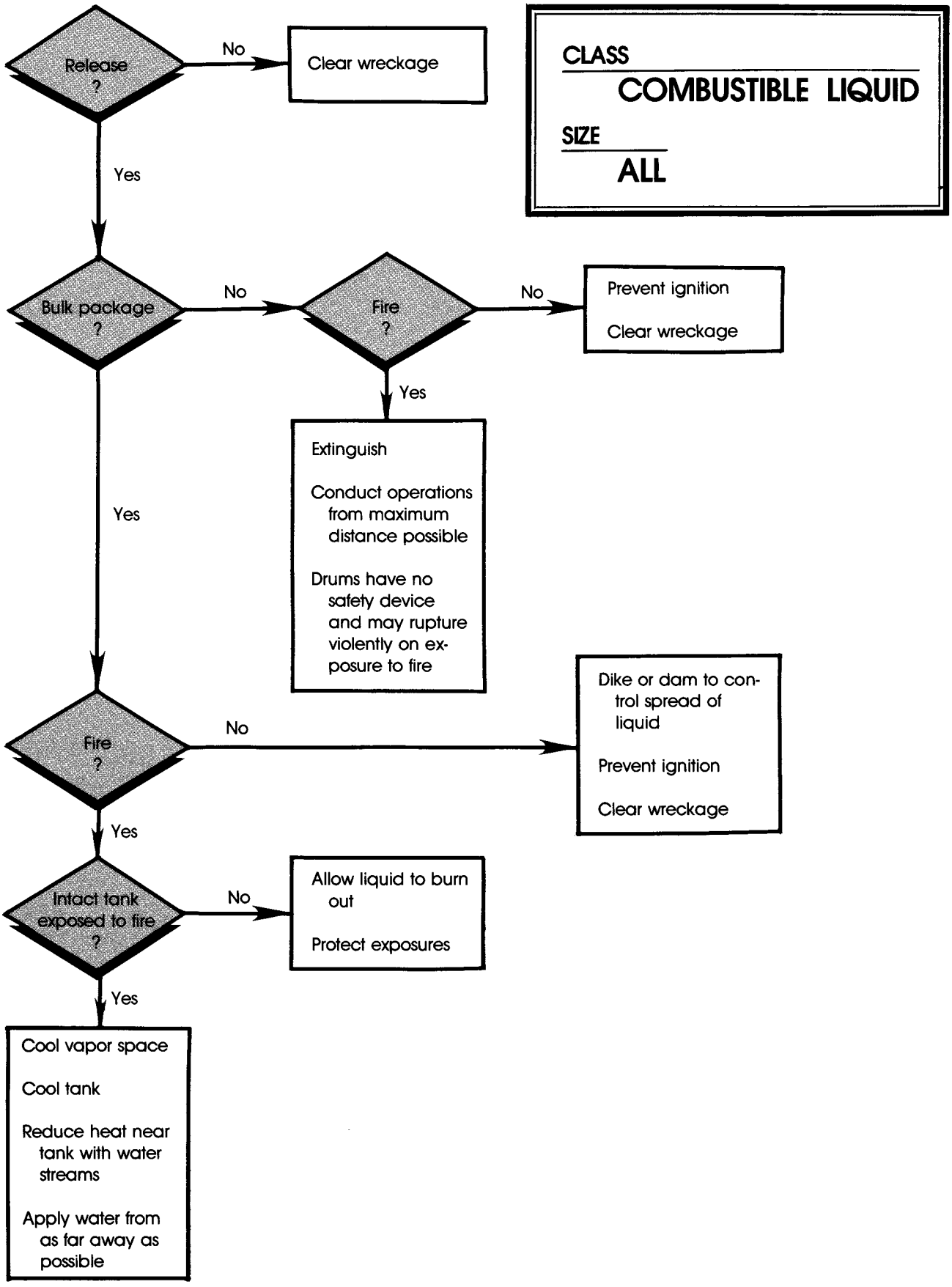
***NOTE:** **Cylinders are equipped with safety devices designed to prevent their rupture in a fire. Aerosol cans have no safety device.**


Release ?
No
Clear wreckage
Yes
Determine name of material and if material or products of combustion are toxic
Protect as required
Yes
Fuming ?
No
Bulk quantity ?
No
On fire or exposed to fire ?
No
Stop leak if able; if not, move so that leak is up
Protect against ignition
Yes
Yes
Yes
Use breathing apparatus
Wear special protective clothing
Do not use water on material
Water fog may remove fumes from air, but do not allow water to contact material
Dike or dam to control spread of liquid and determine potential of foam blanket to reduce vapor hazard
Page 43
A
Let spilled liquid burn if possible
Extinguish other burning material as appropriate
Conduct operations from the maximum distance possible
Drums have no safety devices and will violently rupture on exposure to fire

CLASS
FLAMMABLE LIQUID

SIZE
ALL




CLASS
COMBUSTIBLE LIQUID
SIZE
ALL
Release ?
No
Clear wreckage
Yes
Bulk package ?
No
Fire ?
No
Prevent ignition
Clear wreckage
Yes
Extinguish
Conduct operations from maximum distance possible
Drums have no safety device and may rupture violently on exposure to fire
Yes
Fire ?
No
Dike or dam to control spread of liquid
Prevent ignition
Clear wreckage
Yes
Intact tank exposed to fire ?
No
Allow liquid to burn out
Protect exposures
Yes
Cool vapor space
Cool tank
Reduce heat near tank with water streams
Apply water from as far away as possible

FLAMMABLE SOLID

DOT CLASS

Flammable Solid

DEFINITION

Any solid material, other than an explosive, which under conditions normally incident to transportation is likely to cause fires through friction or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently that it creates a serious transportation hazard. Included in this class are spontaneously combustible and water-reactive materials.

FLAMMABLE SOLIDS (Not A Complete List)

			Reacts with		
UN #	Name	CAS #	Air	Water	Nitrogen
1396	Aluminum (Powder) (Pyrophoric)	7429-90-5	•		
1310	Ammonium Picrate (Wet) (10% or More Water)	131-74-8	•		
(1855)(1401)	Calcium (Metal)	7440-70-2	•	•	
1402	Calcium Carbide	75-20-7		•	
1404	Calcium Hydride	7789-78-8	•	•	
1360	Calcium Phosphide	1305-99-3	•		
(1313)(1314)	Calcium Resinate	9007-13-0	•		
(1333)(3078)	Cerium	7440-45-1	•		•
1407	Cesium	7440-46-2	•	•	
1361	Charcoal-Coal	7440-44-0	•		
(1326)(2545)	Hafnium	7440-58-6	•		•
(1376)(1383)	Iron (Mass or Sponge)	7439-89-6	•		
1415	Lithium	7439-93-2	•	•	•
1410	Lithium Aluminum Hydride	16853-85-3	•	•	
1412	Lithium Amide	7782-89-0	•	•	
1413	Lithium Borohydride	16949-15-8	•	•	
(1414)(2805)	Lithium Hydride	7580-67-8	•	•	
2806	Lithium Nitride	26134-62-3	•		
(1896)(2950)	Magnesium	7439-95-4	•		•
1378	Nickel (Raney Catalyst)	7440-02-0	•		
1338	Phosphorus (Red Amorphous)	7723-14-0	•		
2447	Phosphorus (Yellow/White)	7723-14-0	•		
(1420)(2257)	Potassium	7440-09-7	•	•	
1423	Rubidium	7440-17-7	•	•	

UN #	Name	CAS #	Reacts with		
			Air	Water	Nitrogen
(1421)(1428)(1429)	Sodium	7440-23-5	•	•	
1425	Sodium Amide	7782-92-5	•	•	
1426	Sodium Borohydride	16940-66-2	•		
1427	Sodium Hydride	7646-69-7	•	•	
2318	Sodium Hydrosulfide	16721-80-5		•	
1384	Sodium Hydrosulfite (Sodium Dithionite)	7775-14-6		•	
1431	Sodium Methylate	124-41-4	•	•	
1422	Sodium-Potassium Alloy	11135-81-2	•	•	
2546	Titanium (<20% H_2O)	7440-32-6	•		•
1352	Titanium (>20% H_2O)	7440-32-6	•		•
(2008)(1358)(1932)	Zirconium	7440-67-7	•		•
1437	Zirconium Hydride	7704-99-6	•	•	

RELATED TERMS

Spontaneously Combustible

A material which ignites as a result of retained heat from processing, or which will oxidize to generate heat and ignite, or which absorbs moisture to generate heat and ignite.

Water Reactive

A solid which will chemically react with water to become spontaneously flammable or to give off flammable or toxic gases in dangerous quantities.

BULK SHIPMENTS

Phosphorus and sodium are two major materials classed as flammable solids that are shipped in bulk.

Exposure of phosphorus to air will result in ignition of the phosphorus. If a tank containing phosphorus is opened in an accident, fire will occur. This fire should be fought with dirt or sand, preferably wet. The phosphorus should be contained by dikes so located that the burning phosphorus will not excessively heat the tank. If the tank is exposed to the heat of burning phosphorus for extended periods, violent rupture is possible but not likely.

Spilled phosphorus can be temporarily buried under a mud cap until wrecking operations are complete. The residue from burned phosphorus is phosphorus pentoxide, a corrosive material that will dissolve in water to form phosphoric acid, another corrosive material. Final disposal of tank and phosphorus should be specified by EPA and shipper or consignee.

Sodium is a water-reactive, flammable solid that differs from potassium in that it detonates in water. If a sodium tank leaks, use dry soda ash, dry earth, salt, lime, or powdered limestone. **Do not use water, carbon dioxide, carbon tetrachloride, foam, or any other liquid fire-extinguishing agents including Freons® or Halons®** because they will either cause a fire or react violently with sodium.

PACKAGE SHIPMENTS

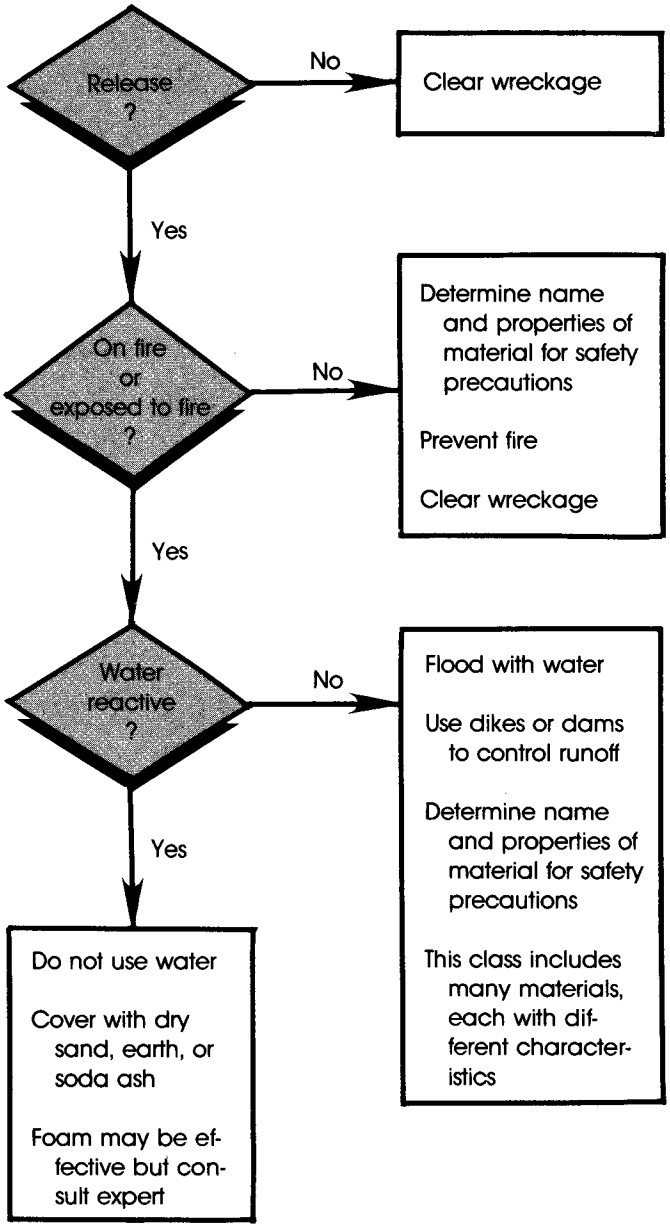
Fires in ground charcoal or in charcoal screenings are best handled by locating, removing, and isolating the burning packages. If this is not practicable, water should be used sparingly to extinguish the visible fire; then remove all the charcoal and separate the wet from the dry material. Wet charcoal is prone to spontaneous ignition and must be disposed of promptly. The dry charcoal should be stored under cover in a dry place and observed for at least five days before further shipment to insure that the fire will not restart.

CLASS

FLAMMABLE SOLID

SIZE

ALL



CORROSIVE MATERIAL

DOT CLASS

Corrosive Material

DEFINITION

A liquid or solid that causes visible destruction or irreversible alterations in human skin tissue at the site of contact, or a liquid that has a severe corrosion rate on steel.

A partial list of corrosive materials is given on page 49.

TEST METHODS

A material is considered to be destructive or to cause irreversible alterations in human skin tissue if, when tested on the intact skin of the albino rabbit, the structure of the tissues at the site of contact is destroyed or changed irreversibly after an exposure period of 4 hours or less.

A liquid is considered to have a severe corrosion rate if its corrosion rate exceeds 0.250 inch (6.350 millimeter) per year on steel at a test temperature of 130°F (54°C).

If human experience or other data indicate that the hazard of a material is greater or less than that indicated by the results of the tests, DOT can revise its classification.

RELATED TERMS

Acid A material or solution containing excess hydrogen ions. The pH of such a material or solution will be less than 7.

Base A material or solution containing excess hydroxyl ions. The pH of such a material or solution will be greater than 7.

Caustic A strong alkaline material which has a corrosive or irritating effect on living tissue and has a pH much greater than 7 (up to 14 maximum).

Fuming A material which will release toxic or irritating fumes if spilled.

BULK SHIPMENTS

In case of accident involving leakage of tanks with "Corrosive" placards:

1. Keep unauthorized personnel out of the area.
2. Avoid contact with contents and inhalation of fumes.
3. Do not apply water to fuming liquid.
4. Corrosive liquids in contact with the body may cause serious or fatal burns. If corrosive liquids contact the body, water should be applied immediately and copiously to wash away the materials. If they can be washed off quickly enough,

injury may be prevented. When handling or transferring such liquids, keep a sufficient supply of water at hand to prevent injury in case of splashes or spills.

5. If it is necessary to transfer the contents of tanks, call upon the shipper or nearest manufacturer of these liquids for assistance.

CORROSIVES (Not A Complete List)

UN #	Name	CAS #
1736	Benzoyl Chloride	98-88-4
1738	Benzyl Chloride	100-44-7
1741	Boron Trichloride	10294-34-5
1744	Bromine	7726-95-6
1751	Chloroacetic Acid	79-11-8
1754	Chlorosulfonic Acid	7790-94-5
1595	Dimethyl Sulfate	77-78-1
2584	Dodecylbenzenesulfonic Acid	1886-81-3
1604	Ethylenediamine	107-15-3
2582	Ferric Chloride (Solution)	10025-77-1
1778	Fluosilicic Acid	16961-83-4
1783	Hexamethylenediamine	124-09-4
1788	Hydrobromic Acid	10035-10-6
1789	Hydrochloric Acid (Muriatic Acid)	7647-01-0
1052	Hydrogen Fluoride	7664-39-3
1790	Hydrofluoric Acid	7664-39-3
1760	Morpholine	100-91-8
1805	Phosphoric Acid	7664-38-2
1807	Phosphoric Anhydride	1314-56-3
1810	Phosphorus Oxychloride	10025-87-3
1806	Phosphorus Pentachloride	10026-13-8
1809	Phosphorus Trichloride	7719-12-3
1812	Potassium Fluoride	7789-23-3
1813	Potassium Hydroxide	1310-58-3
1814	Potassium Hydroxide (Solution)	1310-58-3
1848	Propionic Acid	79-09-4
1818	Silicon Tetrachloride	10026-04-7
1821	Sodium Bisulfate (Anhydrous)	7681-38-1
1690	Sodium Fluoride	7681-49-4
2837	Sodium Hydrogen Sulfate, Hydrate	10034-88-5
1823	Sodium Hydroxide (Solid)	1310-73-2
1824	Sodium Hydroxide (Liquid or Solution)	1310-73-2
(2922)(2949)	Sodium Hydrosulfide	16721-80-5
1825	Sodium Monoxide	1313-59-3
1828	Sulfur Dichloride	10545-99-0
1830	Sulfuric Acid	7664-93-9
1823	Sulfuric Acid (Spent)	7664-93-9
1829	Sulfur Trioxide	7446-11-9
1834	Sulfuryl Chloride	7791-25-5
1835	Tetramethylammonium Hydroxide	10424-65-4

UN #	Name	CAS #
1940	Thioglycolic Acid	123-93-3
1836	Thionyl Chloride	7719-09-7
1837	Thiophosphoryl Chloride	3982-91-0
1827	Tin Tetrachloride	7646-78-8
1838	Titanium Tetrachloride	7550-45-0
2584	Toluenesulfonic Acid	6192-52-5
1839	Trichloroacetic Acid (Solid)	76-03-9
2564	Trichloroacetic Acid (Solution)	76-03-9
2196	Tungsten Hexafluoride	7783-82-6
2443	Vanadium Oxychloride	7727-18-6
2444	Vanadium Tetrachloride	7632-51-1
2475	Vanadium Trichloride	7718-98-1
1840	Zinc Chloride (Solution)	7646-85-7
2503	Zirconium Tetrachloride	10026-11-6

PACKAGE SHIPMENTS

When a vehicle bearing the "Corrosive" placard is discovered in transit with packages leaking, all unnecessary movement of the vehicle must cease and an examination be made of the lading. If practicable, broken or leaking packages should be removed promptly. Any corrosive liquid remaining on the floor or on surrounding packages should be washed away with a copious amount of water or, if water is not available, cleaned up with a liberal application of sand or earth.

Avoid inhalation of fumes. If a person contacts a corrosive liquid, copious amounts of water should be used to wash off the liquid. Washing should continue for a minimum of 15 minutes, and contaminated clothing should be removed.

Fumes of bromine may be neutralized by using ammonia water or "household ammonia" sprayed through a sprinkler or watering pot. Sufficient ammonia should be sprinkled to completely counteract bromine fumes before the broken packages are removed.

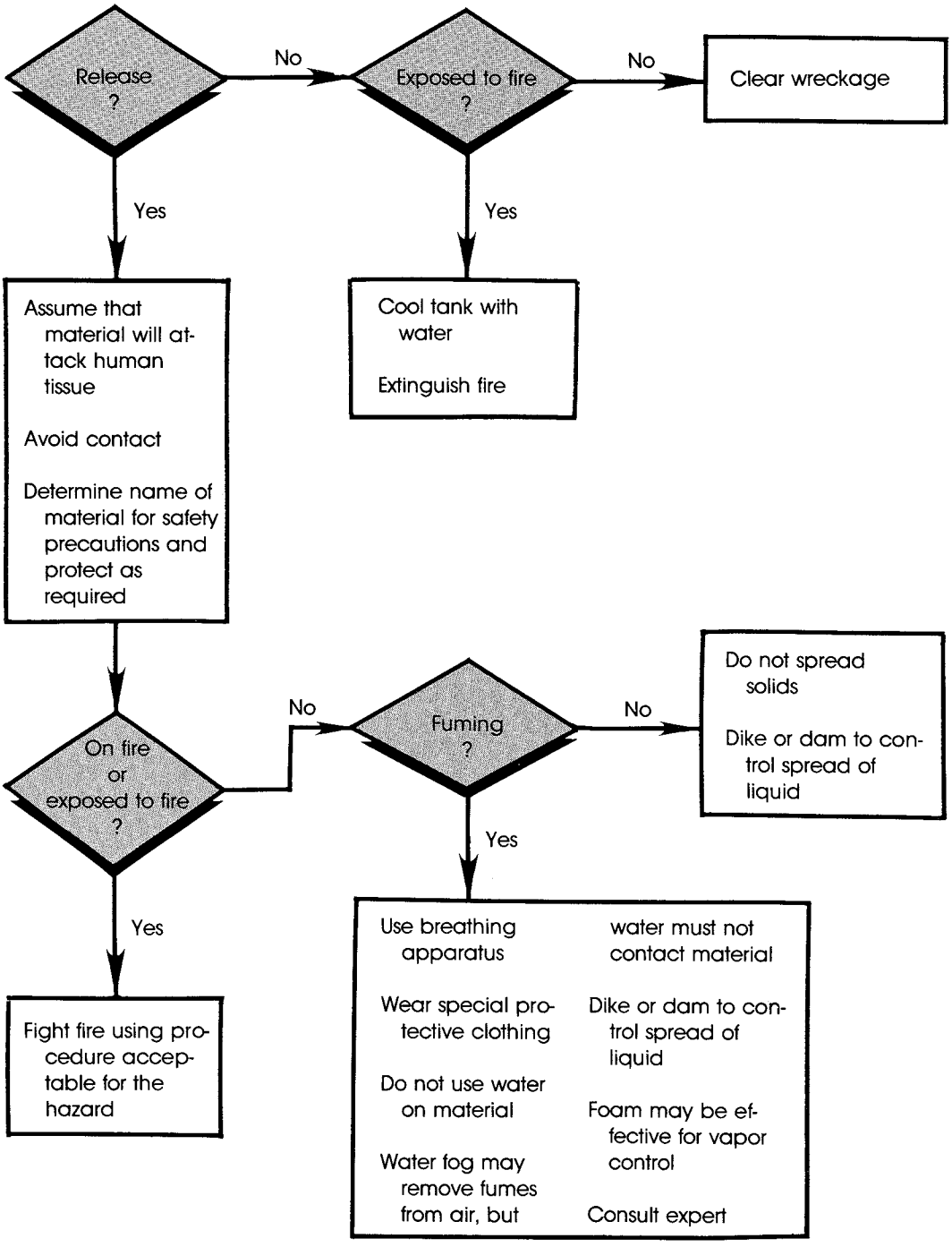
Bromine and chlorine fumes can also be neutralized with "Hypo" (sodium thiosulfate solution). Self-contained breathing apparatus and proper protective gear are *mandatory*!

CLASS

CORROSIVE MATERIAL

SIZE

ALL



IRRITATING MATERIAL

DOT CLASS

Irritating Material

DEFINITION

A liquid or solid which upon contact with fire or when exposed to air gives off dangerous or intensely irritating fumes but not including any Poison A.

PACKAGE SHIPMENTS

Irritating materials are such that persons will not remain in an area contaminated by them unless escape is impossible. In the event of leakage, irritating materials may delay the clearance of wreckage, but they are not particularly hazardous.

If there is a brisk breeze and the shell is not in a confined place, leaking or broken packages may be safely approached from the upwind side for the purpose of moving them out of the way. Use proper respiratory and skin protection.

ETIOLOGIC AGENT

DOT CLASS

Etiologic Agent

DEFINITION

A viable microorganism, or its toxin, which causes or may cause human disease, limited to those agents listed in 42 CFR 72.25(c) of the regulations of the Department of Health and Human Services.

PACKAGE SHIPMENTS

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.

RADIOACTIVE MATERIAL

DOT CLASS

Radioactive Material

DEFINITION

Any material which spontaneously emits ionizing radiation of sufficient magnitude to require placarding as radioactive.

ALL SHIPMENTS

General Instructions

A. Until the extent of the hazard can be determined, keep all persons the greatest practicable distance away. If radioactive material is submerged as a result of 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.

B. Trains and road vehicles may pass if they can do so without stopping in the suspected area and without scattering spilled material.

C. **Persons not properly protected against radiation must not be permitted to approach 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 means of shielding personnel from radiation may be necessary.

D. If material is involved in fire or spillage, avoid exposure to smoke fumes or dust.

E. Get names and addresses of persons who may have been in contact with spilled material and take precautions to avoid further spreading of spilled materials.

F. If there is evidence of any damage to shipping container, determine as soon as possible whether the outside container has been broken open and whether materials have been exposed or spilled. If container is damaged, 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 [90 kilograms]):

1. Keep all persons at least 20 feet (6 meters) away if practicable and do not remain near exposed material unnecessarily.
2. If it is impracticable to keep persons away, sandbag or cover the radioactive material with at least 4 inches (100 millimeters) of earth or sand, using a long-handled shovel. Remain near the material only as long as is necessary to accomplish work.
3. Following notification, the Department of Energy will assist in arranging for removal of the material and any necessary decontamination.

FOR PACKAGES OF HEAVY STEEL OR METAL CONSTRUCTION (weighing 200 pounds [90 kilograms] or more and lined or partially filled with lead, concrete, or paraffin):

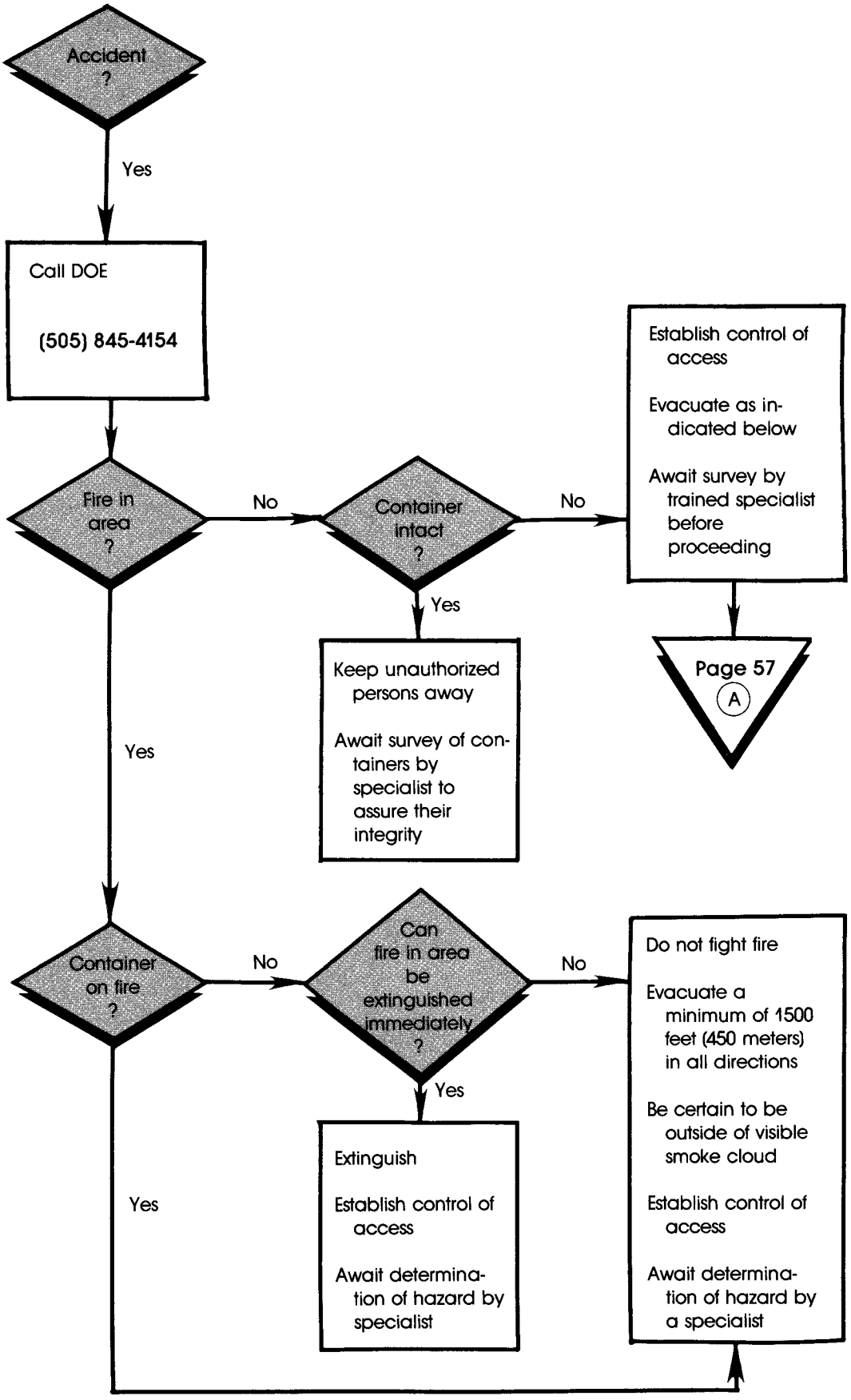
1. If there is any evidence that the container has been broken open or seriously damaged, observe rules in paragraph (A) of the General Instructions above until assistance or further advice has been obtained from a competent authority.
2. Even if the container has not been opened or damaged, persons should not remain near the container unnecessarily until it has been determined that no radiation hazard exists.

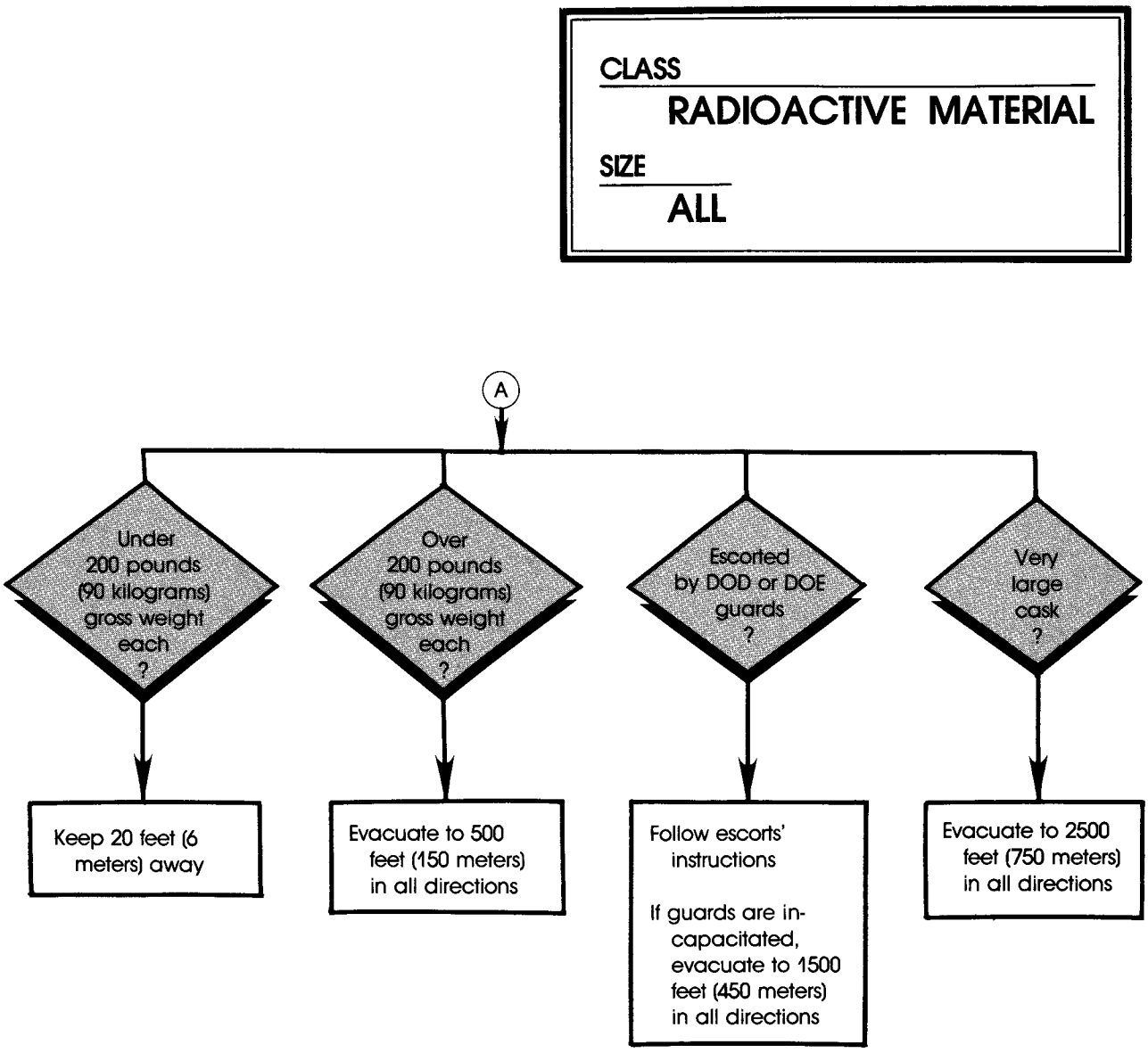
MATERIAL OF LOW ACTIVITY, such as uranium and thorium ores, is packed in ordinary containers such as bags, steel or fiber drums, or wooden or fiber boxes and may be in the form of powders, liquids, sludges, or wastepaper or other scrap materials.

1. Obtain assistance of qualified persons to handle spilled materials.
2. Avoid direct contact with spilled materials.
3. Protect persons from breathing dust. 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 spread of spilled material and keep it out of streams, reservoirs, or other bodies of water.

FOR SHIPMENTS ESCORTED BY THE DEPARTMENT OF ENERGY OR DEPARTMENT OF DEFENSE (sometimes shipped as explosives and radioactive material):

1. If guards are present and not incapacitated, follow their recommendations with regard to safety and elimination of hazards until other assistance arrives.
2. If the guards are incapacitated and the shipment is involved in fire that cannot be readily brought under control, keep all persons at least 1500 feet (450 meters) away and observe the rules in the General Instructions above.
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 Energy Research and Development Administration.
4. In addition to reporting to DOT, immediately report the accident by telephone to the Albuquerque Operations Office of the Department of Energy, Albuquerque, New Mexico (505/845-4154).


Accident ?
Yes
Call DOE
(505) 845-4154
Fire in area ?
No
Container intact ?
No
Establish control of access
Evacuate as indicated below
Await survey by trained specialist before proceeding
Page 57
A
Yes
Keep unauthorized persons away
Await survey of containers by specialist to assure their integrity
Yes
Container on fire ?
No
Can fire in area be extinguished immediately ?
No
Do not fight fire
Evacuate a minimum of 1500 feet (450 meters) in all directions
Be certain to be outside of visible smoke cloud
Establish control of access
Await determination of hazard by a specialist
Yes
Extinguish
Establish control of access
Await determination of hazard by specialist
Yes


CLASS
RADIOACTIVE MATERIAL
SIZE
ALL
A
Under 200 pounds (90 kilograms) gross weight each ?
Over 200 pounds (90 kilograms) gross weight each ?
Escorted by DOD or DOE guards ?
Very large cask ?
Keep 20 feet (6 meters) away
Evacuate to 500 feet (150 meters) in all directions
Follow escorts' instructions
If guards are incapacitated, evacuate to 1500 feet (450 meters) in all directions
Evacuate to 2500 feet (750 meters) in all directions

SPECIAL CATEGORY

WATER-SENSITIVE LIQUIDS I
Metals and Metal Alkyls

NOT A DOT CLASS

Certain materials are violently reactive with water, even approaching explosive violence. Many emergency situations involve water as rain or occur from response procedures. A special section for those involved in hazardous materials accidents with these water-sensitive materials is therefore warranted.

WATER-SENSITIVE REACTIVE METALS (Not a Complete List)
(May be Liquid Depending on Conditions)

UN #	Name	CAS #
2257	Potassium (Metal)—always shipped as a solid, melting point at 146°F (63.7°C)	7440-09-7
1420	Potassium (Metal-Liquid Alloy)	7440-09-07
1428	Sodium (Metal)—always shipped as a solid, melting point at 208°F (97.8°C)	7440-23-5
1429	Sodium (Metal Dispersion in Organic Fluid)	
1421	Sodium (Metal-Liquid Alloy)	
1422	Sodium-Potassium Alloy (Liquid or Solid)	11135-81-2

DEFINITIONS

Pyrophoric Spontaneously ignites in the presence of air.

Hypergolic Spontaneously reacts with a second material to ignite.

Violent Reaction with Water A significant enough release of heat and/or gas, even without air, to cause a violent eruption.

Detonates with Water Reacts with water to liberate hydrogen which can burn or detonate in air.

> An exception is sodium metal which can detonate with water alone. Sodium is always shipped as a solid. Bulk shipments must be melted to a liquid to unload. Sodium may also melt to a liquid if it is involved in a general fire. See Section on Flammable Solids on page 45.

Metal Alkyl Solutions

Many of these materials (even the solids) are dissolved in inert hydrocarbon-type solvents (e.g., hexane).

METAL ALKYLS

UN # U.S.	UN # Canada Europe Export	Name	Acronym	CAS #
		Commercial Scale Materials[a]		
2845	3051	Triethylaluminum	TEA	97-93-8
2845	3051	Tri-*n*-butylaluminum	TNBA	1116-70-7
2845	3051	Triisobutylaluminum	TIBA	100-99-2
2845	3051	Tri-*n*-hexylaluminum	TNHA	1116-73-0
2845	3051	Tri-*n*-octylaluminum	TNOA	1070-00-4
2845	3051	Diisobutylaluminum Hydride	DIBAH	1191-15-7
2845	3051	Isoprenylaluminum	IPRAL	31259-92-4
2845	3052	Ethylaluminum Sesquichloride	EASC	10275-68-2
2845	3052	Diethylaluminum Chloride	DEAC	96-10-6
2845	3052	Diethylaluminum Iodide	DEAI	1040-00-8
2845	3052	Diisobutylaluminum Chloride	DIBAC	1779-25-5
2845	3052	Di-*n*-octylaluminum Iodide	DNOAI	7585-14-0
2845	3052	Ethylaluminum Dichloride	EADC	563-43-9
2845	3052	Isobutylaluminum Dichloride	MONIBAC	1888-87-5
2845	1366	Diethylzinc	DEZ	557-20-0
2845	3053	Di-*n*-hexylmagnesium	DNHM	37509-99-2
		Developmental Scale Materials[b]		
2845	3051	Trimethylaluminum	TMA	97-93-8
2845	3051	Tri-*n*-propylaluminum	TNPA	102-67-0
2845	3052	Methylaluminum Sesquichloride	MASC	12542-85-7
2845	3052	Isobutylaluminum Sesquichloride	IBASC	12090-38-9
2845	3052	Di-*n*-propylaluminumchloride	DNPRAC	3710-19-8
2845	3051	Diethylaluminum Ethoxide	DEAL-E	1586-92-1
2845	3051	Diisobutylaluminum Ethoxide	DIBAL-E	15769-72-9
2845	1075	Triethylborane	TEB	97-94-9
2845	2845	Triisobutylborane	TIBB	1116-39-8
2845		Tri(2-Methylpentyl)-aluminum	TIHAL	3711-23-7

[a]Shipped in all container sizes from 1 liter to tank car loads. Smaller shipments are made in tank trucks, bulk tanks, and in mixed loads.

[b]Usually shipped in smaller quantities.

Spontaneous Exothermic Decomposition

Most alkyl aluminums when heated sufficiently break down to release olefins, hydrogen, and aluminum.

> Diethylzinc (100%; UN 1366) may undergo violent exothermic decomposition if heated above 248°F (120°C).

BULK SHIPMENTS

No standard methods have been developed for extinguishing large-scale metal alkyl fires. Contact manufacturers for advice.

Small fires may be extinguished using dry chemical powder in large excess (i.e., 10 pounds (22 kilograms) dry chemical per 1 pound (0.45 kilograms) aluminum alkyl). Vermiculite has been used to float on top of a spill to minimize air contact.

Two manufacturers (page 62) offer training films on the use of water fog.

> Water streams, water-based foams, chemical foams, and halogenated extinguishers (i.e., carbon tetrachloride, Halon®, or Freon®) should *not* be used.

The following containers are typical of those used for shipping metal alkyls:

• Tank car (DOT-105A300W)	11 000 gal.	(42 000 L)
	20 000 gal.	(76 300 L)
	25 000 gal.	(95 400 L)
• Tank trailer (DOT-MC330 or 331)	6200 gal.	(23 500 L)
	7100 gal.	(26 900 L)
• Portable tanks (DOT-51)	250 gal.	(945 L)
	430 gal.	(1635 L)
	5265 gal.	(19 930 L)
• Dual-valve cylinders (DOT-4BA-240)	26 gal.	(98.4 L)
	5 gal.	(19.6 L)
	2.6 gal.	(9.8 L)
• Small containers (DOT-3AA-1800)	0.2 gal.	(0.68 L)
	0.97 gal.	(3.7 L)

> Containers of metal alkyls are always shipped under a positive nitrogen pressure.

> Many compounds classed as metal organic or metal alkyl may be as hazardous as those listed above. There are exceptions, but caution is advised since other hazards may exist.

Solutions of metal alkyls with sufficient solvent to assure they are not pyrophoric are shipped in the United States and Canada as UN-9195 (Metal Alkyl Solution, N.O.S.). The reaction with *water* will still be violent. For export or in Europe the number for metal alkyl solutions is UN 1993 (Flammable Liquid, N.O.S.).

In case of incidents involving these type of materials contact:

CHEMTREC®, 24 hrs., 7 days
800/424-9300 in the U.S. or
Call collect
202/483-7616 outside U.S. (except Canada)

CANUTEC
in Canada
Call collect
613/996-6666

The manufacturers listed below have useful information and training films:

Texas Alkyls (Division of Akzo)
713/479-8411, 24 hrs.
800/227-7070

Ethyl Corporation
504/344-7147, 24 hrs.
800/535-3030

If these materials are used in or transported through your area, you should know what to do in case of a spill. Disruption of normal traffic may route these materials through your area.

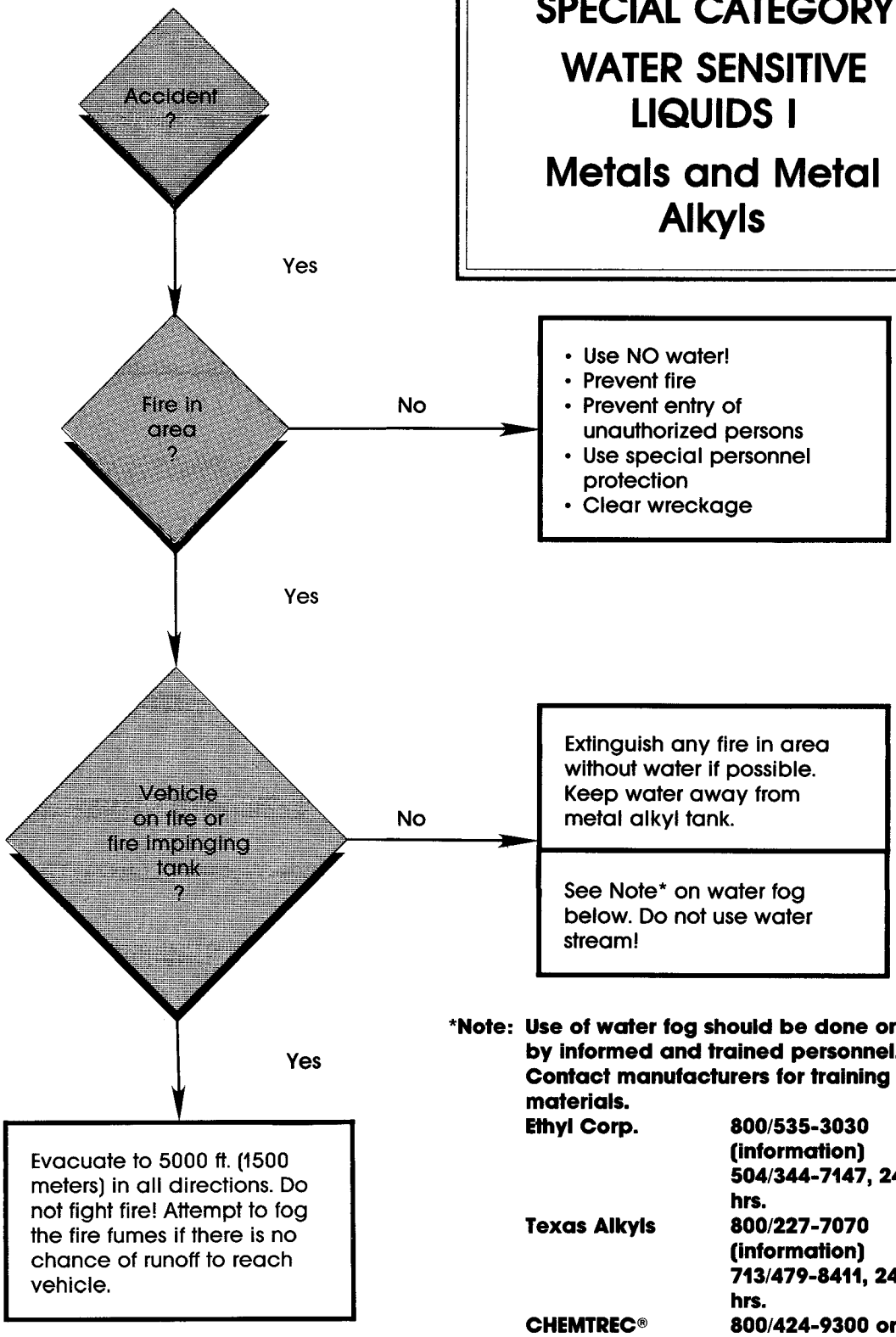
PERSONNEL PROTECTIVE EQUIPMENT

Eye protection must include tight-fitting goggles, a face shield, and a hard hat even for small quantities. Skin contact of undiluted metal alkyls will cause instant necrosis or carbonization of the skin. Alkyl aluminum spills tend to form a crust with time and may not even fume. Contacting and breaking this crust will give an instant painful burn on the skin and it may also reignite. These burns are thermal and in some cases also chemical. Any instance of contact of these products with personnel requires trained medical evaluation. Use typical thermal burn and chemical burn treatment and keep patient warm until medical help arrives. Be aware of the possibility of shock if the burns are anything other than minimal.

Exposure to other than minimal quantities requires an aluminized body proximity suit worn over fire-retardant coveralls. Gloves used in operations should be aluminized leather and insulated. They should be loose fitting for instant removal. Contact material manufacturers for recommendations.

Respiratory protection (self-contained breathing apparatus) is also necessary in long-term exposure to avoid an irritation of the lungs called "metal fume fever." Medical attention is required after any exposure to metal alkyl fires. Some of the metal alkyls have halogen in their structure, so the fumes may also contain hydrogen chloride, hydrogen bromide, or hydrogen iodide.

SPECIAL CATEGORY
WATER SENSITIVE LIQUIDS I
Metals and Metal Alkyls



***Note: Use of water fog should be done only by informed and trained personnel. Contact manufacturers for training materials.**

Ethyl Corp.	**800/535-3030 (information) 504/344-7147, 24 hrs.**
Texas Alkyls	**800/227-7070 (information) 713/479-8411, 24 hrs.**
CHEMTREC®	**800/424-9300 or Call collect 202/483-7616**
CANUTEC	**Call collect 613/996-6666**

MNL10-EB/Dec. 1990

INITIAL EMERGENCY ASSESSMENT—INITIAL RESPONSE ACTION

Action Checklist for Assessment and Response to a Hazardous Material Incident

EXPECT HAZARDOUS MATERIALS TO BE INVOLVED IN ALL INCIDENTS.

☐ **Control Access.**

STAY OUT UNTIL ALL HAZARDOUS MATERIALS ARE IDENTIFIED AND ADVICE ON EMERGENCY ACTION AND PERSONAL PROTECTION HAS BEEN OBTAINED.

☐ **Are Hazardous Materials Involved?**

- *For Fixed Facilities.* Check pre-emergency plan of the facility to locate hazardous materials storage and use locations and for material identification. Contact facility supervision directly.

Chemical Transportation Emergency Center (CHEMTREC)®

For Chemical Emergency
Spill, Leak, Fire, Exposure, or Accident

Phone: Day or Night
In continental United States call toll free *800/424-9300
Outside the continental United States (except Canada) call collect *202/483-7616
(In Canada call CANUTEC collect *613/996-6666)

*Add long-distance access number if required.

CHEMTREC® can usually provide hazard information warnings and guidance when given only the NAME OF THE PRODUCT and the NATURE OF THE PROBLEM. For more detailed information and/or assistance, or if product is unknown, attempt to provide as much of the following additional information as possible:

Name of Caller and Call Back Number
Products Involved
Nature of the Problem
Location of the Problem
Name of Shipper or Manufacturer
Container Type
Railcar or Truck Number
Carrier Name
Weather Conditions

- *For Transportation Situations.* Check for container shapes, markings, colors, placards, identification number, and labels that may indicate the presence of a hazardous material; contact employees of the transportation company for shipping paper information and location of hazardous materials; check vehicle identification numbers and/or initials to permit product identification from shipping papers when the carriers' dispatcher has been contacted. Mixed and nonplacarded loads may contain materials that can become dangerous and even explosive if they spill and/or mix. CHEMTREC may help with product identification.

☐ **Make Certain You Have the Correct Spelling of the Name of the Material.**

- Look for UN/DOT and/or CAS number for correct identification. (Spelling of dissimilar materials may be confused.)

☐ **Determine Hazards and Properties of Each Material, Emergency Response Action, Personnel Protection, and Evacuation Recommendations Using:**

- *CHEMTREC* with its direct contact with the shipper.
- *Emergency Response Manuals* or other on-scene data.

☐ **Estimate the Potential Harm.**

- Predict the area affected by the situation. Weather conditions including wind direction and speed should be obtained and monitored.
- Determine risk to people, property, and environment within the affected area.

☐ **Determine If Your Involvement Will Favorably Change the Outcome or Will Make Things Worse.**

☐ **Do You Have the Resources, Personnel, and Equipment Available to Favorably Change the Outcome Now?**

- If nothing is to be gained, do not get directly involved. Seek additional assistance.

☐ **Priority for Your Direct Involvement in a Hazardous Materials Incident:**

- *People*

  Are people exposed to risk?

  Can people trapped or exposed to risk be safely removed from the danger area?

  If you must enter the danger area to rescue people, can you move them to safety without becoming trapped, injured, or killed yourself?

  Are response personnel trained for this type of emergency?

  How will you protect yourself and those you hope to rescue from the harmful effects of the hazardous materials involved? (Protective equipment per 29 CFR-1910.20 represents the minimum when going into an unknown or hazardous area.)

- *Property*

  Are property, buildings, or systems (communication and power lines, etc.) exposed to risk?

  Will your direct involvement prevent or reduce damage to exposed property or systems without harm to yourself or others?

- *Environment*

  Can you safely prevent or reduce harm to the environment?

  Can you safely stop a leak or contain a spill?

  Do you have the proper safety equipment to do the job without injury to yourself and others?

  Do you know how to safely accomplish what you want to do?

☐ **Have You Contacted Facility or Carrier Supervisors and Discussed Your Proposed Response with Them Before Taking Action?**

☐ **Use Personal Protective Equipment, Which Should Include Protective Clothing and Self-Contained Breathing Apparatus.**

- Protective clothing is not universal for hazardous material spills. Make certain your equipment, including gloves and boots, are those recommended by the manufacturer for the material involved in the spill. Check UN number and CAS number. You may also want to check with chemical manufacturer or CHEMTREC.
- Avoid breathing vapors and skin contact with vapors and spilled material.
- If clothing or equipment becomes contaminated, leave the danger area and remove contaminated items as soon as possible. Wash material from skin.

☐ **How Will You Contain the Spilled Material If It Is Safe and Possible to Do So?**

- It may be the best course of action to allow the material to burn if it is on fire. Other initial on-site control and containment methods should be considered.

☐ **If at Any Time You Are Unsure What to Do Next or You Feel the Situation Is Getting Out of Control You Should:**

1. Withdraw to a safe location, based on wind direction and type of product.
2. Keep others away from the hazard.
3. Get help or advice.

☐ **One Person Should Be in Command of the Overall Operations.**

- Consult specialists who know the hazards of the products involved and who can advise on a safe and effective response.
- Consult officials of the carrier or facility.
- Consult state and national contingency plans.

☐ **Establish a Command Post a Safe Distance from Incident.**

- *All* response actions must be coordinated through the command post.
- A record should be kept of decisions and actions and a time log kept to indicate sequence of events.

☐ **Establish a Patrolled Perimeter for Emergency Response Personnel a Safe Distance from the Spilled Material to Control Access.**

This should be at the distance listed in emergency guides, if available. Another patrolled perimeter must be established at a greater distance from the spill to keep the public and other nonessential personnel away from the active area and out of the command post.

☐ **Establish Communications.**

- *Radio and Phone Communications*
  1. All communications equipment should be compatible. Make one frequency for the on-scene commander.
  2. Telephone service may be necessary for security and flexibility.
- *Public Information*
  1. Appoint a public information office to conduct news conferences at specified times at a specified location, which will not interfere with control operations.
  2. Factual information should be provided but no opinions given on the cause of the problem or responsibility.
  3. News media can be helpful if a limited evacuation is necessary. Reasons for evacuation and information on where evacuees should go should be given.

This card is designed to be used in conjunction with a training manual, *A Guide to the Safe Handling of Hazardous Materials Accidents, Manual 10*, available from ASTM, 1916 Race St., Philadelphia, PA 19103 (215/299-5400).

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