

Hazardous Materials Awareness

N.F.P.A. 472 – 2013

Chapter 4



June 01, 2016



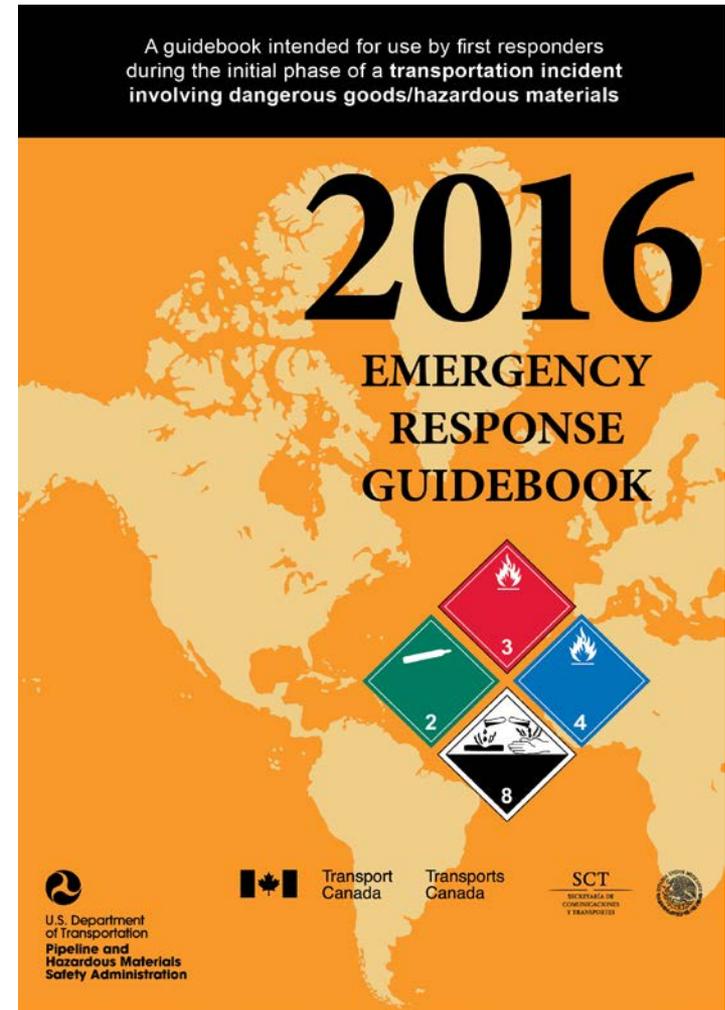
CONNECTICUT FIRE ACADEMY



Analyze the Incident

Collecting Hazard Information

Identify three methods for determining the appropriate guide page for a specific hazardous Material.



NFPA 4.2.3(1)

CONNECTICUT FIRE ACADEMY

Analyze the Incident

Collecting Hazard Information

1. Yellow Pages

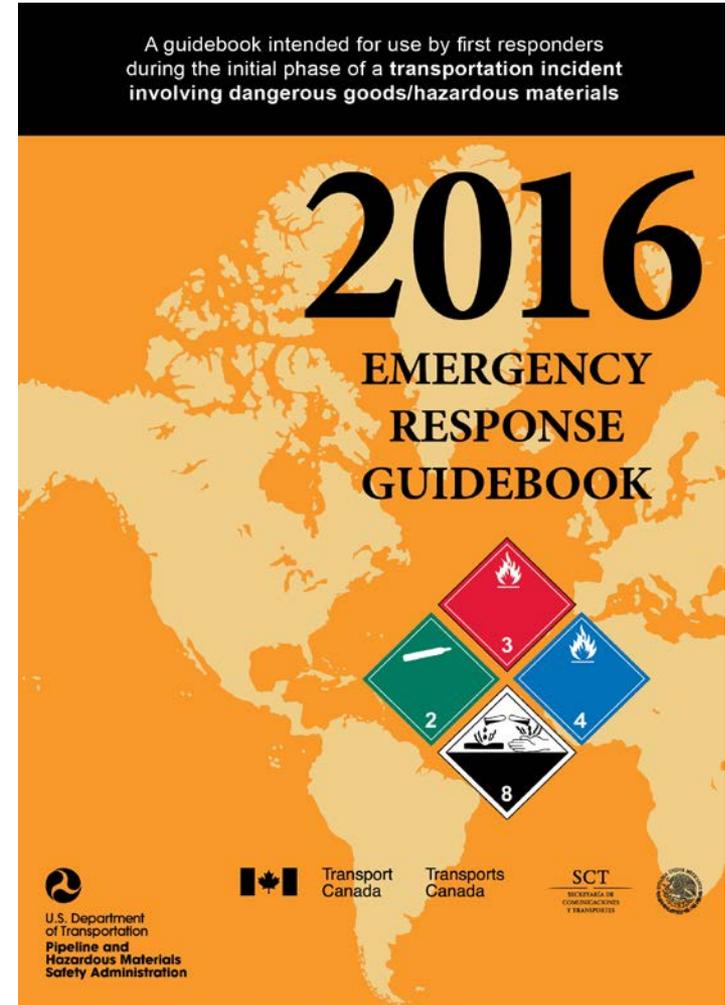
4 digit UN/NA ID Number

2. Blue Pages

Name of Material

3. Table of Placards

*When UN/NA number or
Material Name unavailable ...
but placard is visible*

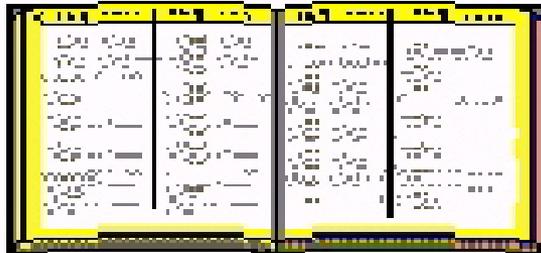


NFPA 4.2.3(1)

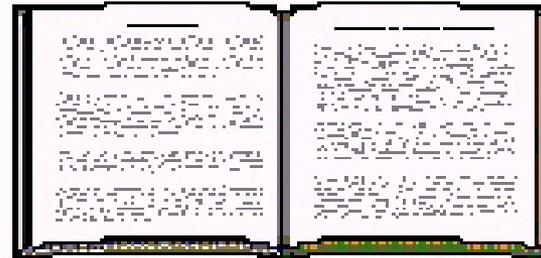
CONNECTICUT FIRE ACADEMY

Analyze the Incident

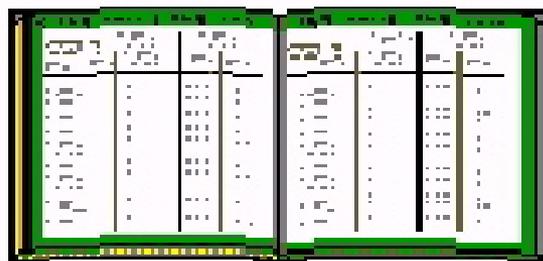
Yellow Pages ID Number



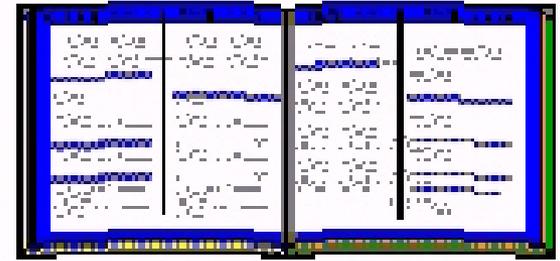
Orange Pages Guide Numbers



White Pages General Info



Green Pages Initial Isolation



Blue Pages Chemical Name

Analyze the Incident

Informational Pages

Front of Book

How To Use the ERG

Table of Contents

Safety Precautions

Hazard Classification

Table of Placards

Rail / Road ID Chart

GHS Class & Labeling

Intermodal Codes

Pipeline Resources

Note: In the 2016 ERG

White pages are in new locations from 2008 and 2012: Additional information added

BEFORE AN EMERGENCY – BECOME FAMILIAR WITH THIS GUIDEBOOK! In the U.S., according to the requirements of the U.S. Department of Labor's Occupational Safety and Health Administration (OSHA, 29 CFR 1910.120), and regulations issued by the U.S. Environmental Protection Agency (EPA, 40 CFR Part 311), first responders must be trained regarding the use of this guidebook.

RESIST RUSHING IN!

APPROACH INCIDENT FROM UPWIND
STAY CLEAR OF ALL SPILLS, VAPORS, FUMES,
SMOKE AND SUSPICIOUS SOURCES



Analyze the Incident

Informational Pages

Back of Book

User's Guide'

Guidebook Contents

Intro to Isolation Table

P.P.E.

Fire & Spill Control

B.L.E.V.E. Chart

Terrorism

I.E.D. Chart

Glossary of Terms

Emergency Phone Numbers

Note: In the 2016 ERG

White pages are in new locations from 2008 and 2012: Additional information added

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RESIST RUSHING IN!

APPROACH INCIDENT FROM UPWIND
STAY CLEAR OF ALL SPILLS, VAPORS, FUMES,
SMOKE AND SUSPICIOUS SOURCES





Analyze the Incident

Four Digit ID Number

- Placard
- Orange Panel
- Shipping Papers
- Packaging
- “P” Indicates Polymerization Hazard

ID Guide No. No.	Name of Material	ID Guide No. No.	Name of Material	ID Guide No. No.	Name of Material	ID Guide No. No.	Name of Material
1035 115	Ethane	1050 125	Hydrogen chloride, anhydrous	1066 121	Nitrogen, compressed	1079 125	Sulfur dioxide
1035 115	Ethane, compressed	1051 117	AC	1067 124	Dinitrogen tetroxide	1079 125	Sulphur dioxide
1036 118	Ethylamine	1051 117	Hydrocyanic acid, aqueous solutions, with more than 20% Hydrogen cyanide	1067 124	Nitrogen dioxide	1080 126	Sulfur hexafluoride
1037 115	Ethyl chloride	1051 117	Hydrogen cyanide, anhydrous, stabilized	1069 125	Nitrosyl chloride	1080 126	Sulphur hexafluoride
1038 115	Ethylene, refrigerated liquid (cryogenic liquid)	1051 117	Hydrogen cyanide, stabilized	1070 122	Nitrous oxide	1081 116P	Tetrafluoroethylene, stabilized
1039 115	Ethyl methyl ether	1051 117	Hydrogen cyanide, stabilized	1070 122	Nitrous oxide, compressed	1082 119P	Trifluorochloroethylene, stabilized
1039 115	Methyl ethyl ether	1052 125	Hydrogen fluoride, anhydrous	1071 119	Oil gas	1083 118	Trimethylamine, anhydrous
1040 119P	Ethylene oxide	1053 117	Hydrogen sulfide	1071 119	Oil gas, compressed	1085 116P	Vinyl bromide, stabilized
1040 119P	Ethylene oxide with Nitrogen	1053 117	Hydrogen sulphide	1072 122	Oxygen	1086 116P	Vinyl chloride, stabilized
1041 115	Carbon dioxide and Ethylene oxide mixture, with more than 9% but not more than 87% Ethylene oxide	1055 115	Isobutylene	1072 122	Oxygen, compressed	1087 116P	Vinyl methyl ether, stabilized
1041 115	Carbon dioxide and Ethylene oxide mixtures, with more than 6% Ethylene oxide	1056 121	Krypton	1073 122	Oxygen, refrigerated liquid (cryogenic liquid)	1088 127	Acetal
1041 115	Ethylene oxide and Carbon dioxide mixture, with more than 9% but not more than 87% Ethylene oxide	1056 121	Krypton, compressed	1075 115	Butane	1089 129	Acetaldehyde
1041 115	Ethylene oxide and Carbon dioxide mixture, with more than 9% but not more than 87% Ethylene oxide	1057 115	Lighter refills (cigarettes) (flammable gas)	1075 115	Butane mixture	1090 127	Acetone
1041 115	Ethylene oxide and Carbon dioxide mixtures, with more than 6% Ethylene oxide	1057 115	Lighters (cigarettes) (flammable gas)	1075 115	Butylene	1091 127	Acetone oils
1043 125	Fertilizer, ammoniating solution, with free Ammonia	1057 115	Lighters (cigarettes) (flammable gas)	1075 115	Isobutane	1092 131P	Acrolein, stabilized
1044 126	Fire extinguishers with compressed gas	1058 120	Liquefied gases, non-flammable, charged with Nitrogen, Carbon dioxide or Air	1075 115	Isobutane mixture	1093 131P	Acrylonitrile, stabilized
1044 126	Fire extinguishers with liquefied gas	1060 116P	Methylacetylene and Propadiene mixture, stabilized	1075 115	Isobutylene	1098 131	Allyl alcohol
1045 124	Fluorine	1060 116P	Propadiene and Methylacetylene mixture, stabilized	1075 115	Liquefied petroleum gas	1099 131	Allyl bromide
1045 124	Fluorine, compressed	1061 118	Methylamine, anhydrous	1075 115	LPG	1100 131	Allyl chloride
1046 121	Helium	1062 123	Methyl bromide	1075 115	Petroleum gases, liquefied	1104 129	Amyl acetates
1046 121	Helium, compressed	1063 115	Methyl chloride	1075 115	Propane	1105 129	Amyl alcohols
1048 125	Hydrogen bromide, anhydrous	1063 115	Refrigerant gas R-40	1075 115	Propane mixture	1105 129	Pentanolis
1049 115	Hydrogen	1064 117	Methyl mercaptan	1075 115	Propylene	1106 132	Amylamines
1049 115	Hydrogen, compressed	1065 121	Neon	1076 125	CG	1107 129	Amyl chloride
		1065 121	Neon, compressed	1076 125	Diphosgene	1108 128	n-Amylene
		1066 121	Nitrogen	1076 125	DP	1108 128	1-Pentene
				1076 125	Phosgene	1109 129	Amyl formates
				1077 115	Propylene	1110 127	n-Amyl methyl ketone
				1078 126	Dispersant gas, n.o.s.	1110 127	Amyl methyl ketone
				1078 126	Refrigerant gas, n.o.s.	1110 127	Methyl amyl ketone

For Spill / No Fire and “Highlighted”

Go To “GREEN PAGES

Yellow Pages Numerical Listing



CONNECTICUT FIRE ACADEMY



Analyze the Incident

Name of Material

- Placard
- Shipping Papers
- Packaging
- “P” Indicates Polymerization Hazard

Name of Material	Guide No.	ID No.	Name of Material	Guide No.	ID No.	Name of Material	Guide No.	ID No.	Name of Material	Guide No.	ID No.
Alcohols, toxic, n.o.s.	131	1986	Alkaloid salts, liquid, n.o.s. (poisonous)	161	3140	Allyl bromide	131	1099	Aluminum remelting by-products	138	3170
Aldehydes, flammable, poisonous, n.o.s.	131	1988	Alkaloid salts, solid, n.o.s. (poisonous)	161	1544	Allyl chloride	131	1100	Aluminum resinates	133	2715
Aldehydes, flammable, toxic, n.o.s.	131	1988	Alkylamines, n.o.s.	132	2733	Allyl chloroformate	135	1722	Aluminum silicon powder	138	1398
Aldehydes, n.o.s.	129	1989	Alkylamines, n.o.s.	132	2734	Allyl chloroformate	135	1722	Aluminum smelting by-products	138	3170
Aldehydes, poisonous, n.o.s.	131	1988	Alkylamines, n.o.s.	153	2735	Allyl formate	131	2336	Amines, flammable, corrosive, n.o.s.	132	2733
Aldehydes, toxic, n.o.s.	131	1988	Alkyl phenols, liquid, n.o.s. (including C2-C12 homologues)	163	3145	Allyl glycidyl ether	129	2219	Amines, liquid, corrosive, flammable, n.o.s.	132	2734
Aldol	163	2839	Alkyl phenols, solid, n.o.s. (including C2-C12 homologues)	163	2430	Allyl iodide	132	1723	Amines, liquid, corrosive, flammable, n.o.s.	163	2735
Alkali metal alcoholates, self-heating, corrosive, n.o.s.	136	3206	Alkyl sulfonic acids, liquid, with more than 5% free Sulfuric acid	153	2584	Allyl isothiocyanate, stabilized	165	1545	Amines, liquid, corrosive, n.o.s.	163	2735
Alkali metal alloy, liquid, n.o.s.	138	1421	Alkyl sulfonic acids, liquid, with not more than 5% free Sulfuric acid	153	2586	Allyltrichlorosilane, stabilized	165	1724	Amines, solid, corrosive, n.o.s.	164	3259
Alkali metal amalgam	138	1389	Alkyl sulfonic acids, solid, with more than 5% free Sulfuric acid	153	2583	Aluminum, molten	169	9260	Amines, solid, corrosive, n.o.s.	154	3259
Alkali metal amalgam, liquid	138	1389	Alkyl sulfonic acids, solid, with not more than 5% free Sulfuric acid	153	2585	Aluminum alkyl halides	135	3052	2-Amino-4-chlorophenol	161	2673
Alkali metal amalgam, solid	138	1389	Alkyl sulfonic acids, solid, with more than 5% free Sulfuric acid	153	2583	Aluminum alkyl halides, solid	135	3052	2-Amino-5-diethylaminopentane	163	2846
Alkali metal amides	139	1390	Alkyl sulfonic acids, solid, with not more than 5% free Sulfuric acid	153	2585	Aluminum alkyl halides, solid	135	3461	2-Amino-8-dinitrophenol, wetted with not less than 20% water	113	3317
Alkali metal dispersion	138	1391	Alkyl sulfonic acids, solid, with not more than 5% free Sulfuric acid	153	2585	Aluminum alkyl hydrides	138	3076	2-(2-Aminoethoxy)ethanol	154	3055
Alkali metal dispersion, flammable	138	3482	Alkylsulfuric acids	156	2571	Aluminum alkyls	135	3051	N-Aminoethylpiperazine	153	2816
Alkaline earth metal alcoholates, n.o.s.	138	3205	Alkylsulphuric acids	156	2571	Aluminum borohydride	135	2870	Aminophenols	162	2512
Alkaline earth metal alloy, n.o.s.	138	1393	Alkyl sulphonic acids, liquid, with more than 5% free Sulphuric acid	153	2584	Aluminum borohydride in devices	135	2870	Aminopyridines	163	2671
Alkaline earth metal amalgam	138	1392	Alkyl sulphonic acids, liquid, with not more than 5% free Sulphuric acid	153	2586	Aluminum bromide, anhydrous	137	1725	Ammonia, anhydrous	125	1005
Alkaline earth metal amalgam, liquid	138	1392	Alkyl sulphonic acids, solid, with more than 5% free Sulphuric acid	153	2583	Aluminum bromide, solution	164	2580	Ammonia, solution, with more than 10% but not more than 35% Ammonia	154	2672
Alkaline earth metal amalgam, solid	138	3402	Alkyl sulphonic acids, solid, with not more than 5% free Sulphuric acid	153	2585	Aluminum carbide	138	1394	Ammonia, solution, with more than 35% but not more than 50% Ammonia	125	2073
Alkaline earth metal dispersion	138	1391	Alkyl sulphuric acids	156	2571	Aluminum chloride, anhydrous	137	1726	Ammonia solution, with more than 50% Ammonia	125	3318
Alkaline earth metal dispersion, flammable	138	3482	Alkyl sulphuric acids	156	2571	Aluminum chloride, solution	154	2581	Ammonium arsenate	151	1546
Alkaloids, liquid, n.o.s. (poisonous)	161	3140	Allyl acetate	131	2333	Aluminum dross	138	3170	Ammonium bifluoride, solid	164	1727
Alkaloids, solid, n.o.s. (poisonous)	161	1544	Allyl alcohol	131	1088	Aluminum ferrosilicon powder	139	1395	Ammonium bifluoride, solution	154	2817
			Allylamine	131	2334	Aluminum hydride	138	2463	Ammonium dichromate	141	1439
						Aluminum nitrate	140	1438	Ammonium dinitro-o-cresolate	141	1843
						Aluminum phosphide	139	1397			
						Aluminum phosphide pesticide	167	3048			
						Aluminum powder, coated	170	1309			
						Aluminum powder, pyrophoric	136	1383			
						Aluminum powder, uncoated	138	1396			
						Aluminum processing by-products	138	3170			

For Spill / No Fire and “Highlighted”

Go To “GREEN PAGES”

Blue Pages Alphabetical Listing



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CONNECTICUT FIRE ACADEMY

Analyze the Incident

Guide Numbers

– Potential Hazards

– Health

– Fire / Explosion

– Public Safety

– Protective Clothing

– Evacuation

– Emergency Response

– Fire

– Spill or Leak

– First Aid

Remember! It's called a "Guidebook"

Because it's only a "Guide"

GUIDE 124	GASES - TOXIC AND/OR CORROSIVE - OXIDIZING	ERG2008	ERG2008	GASES - TOXIC AND/OR CORROSIVE - OXIDIZING	GUIDE 124
POTENTIAL HAZARDS			EMERGENCY RESPONSE		
HEALTH <ul style="list-style-type: none">• TOXIC; may be fatal if inhaled or absorbed through skin.• Fire will produce irritating, corrosive and/or toxic gases.• Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.• Runoff from fire control may cause pollution.			FIRE <p>Small Fire: Water only; no dry chemical, CO₂ or Halon®.</p> <ul style="list-style-type: none">• Contain fire and let burn. If fire must be fought, water spray or fog is recommended.• Do not get water inside containers.• Move containers from fire area if you can do it without risk.• Damaged cylinders should be handled only by specialists. <p>Fire Involving Tanks</p> <ul style="list-style-type: none">• Fight fire from maximum distance and use unmanned hose holders or monitor nozzles.• Cool containers with flooding quantities of water until well after fire is out.• Do not direct water at source of leak or safety devices; icing may occur.• Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.• ALWAYS stay away from tanks engulfed in fire.• For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.		
FIRE OR EXPLOSION <ul style="list-style-type: none">• Substance does not burn but will support combustion.• Vapors from liquefied gas are initially heavier than air and spread along ground.• These are strong oxidizers and will react vigorously or explosively with many materials including fuels.• May ignite combustibles (wood, paper, oil, clothing, etc.).• Some will react violently with air, moist air and/or water.• Cylinders exposed to fire may vent and release toxic and/or corrosive gas through pressure relief devices.• Containers may explode when heated.• Ruptured cylinders may rocket.			SPILL OR LEAK <ul style="list-style-type: none">• Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire.• Do not touch or walk through spilled material.• Keep combustibles (wood, paper, oil, etc.) away from spilled material.• Stop leak if you can do it without risk.• Use water spray to reduce vapors or divert vapor or cloud drift. Avoid allowing water runoff to contact spilled material.• Do not direct water at spill or source of leak.• If possible, turn leaking containers so that gas escapes rather than liquid.• Prevent entry into waterways, sewers, basements or confined areas.• Isolate area until gas has dispersed.• Ventilate the area.		
PUBLIC SAFETY <ul style="list-style-type: none">• CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.• As an immediate precautionary measure, isolate spill or leak area for at least 100 meters (330 feet) in all directions.• Keep unauthorized personnel away.• Stay upwind.• Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks).• Keep out of low areas.• Ventilate closed spaces before entering.			FIRST AID <ul style="list-style-type: none">• Move victim to fresh air. • Call 911 or emergency medical service.• Give artificial respiration if victim is not breathing.• Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.• Administer oxygen if breathing is difficult.• Clothing frozen to the skin should be thawed before being removed.• Remove and isolate contaminated clothing and shoes.• In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.• Keep victim warm and quiet. • Keep victim under observation.• Effects of contact or inhalation may be delayed.• Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.		
PROTECTIVE CLOTHING <ul style="list-style-type: none">• Wear positive pressure self-contained breathing apparatus (SCBA).• Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection.• Structural firefighters' protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations where direct contact with the substance is possible.					
EVACUATION <p>Spill</p> <ul style="list-style-type: none">• See Table 1 - Initial Isolation and Protective Action Distances. <p>Fire</p> <ul style="list-style-type: none">• If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.					



NFPA 4.2.3(1)

CONNECTICUT FIRE ACADEMY

Analyze the Incident

Table of Isolation & Protective Action

1. Id. # Name of Material

- Numerical Order

– Small / Large Spills

- First Isolate

- Protect Downwind

- Day / Night

2. Table of Water Reactive

- TIH Gases

3. Six Common TIH Gases

- TIH Gases

Page 300

TABLE 1 - INITIAL ISOLATION AND PROTECTIVE ACTION DISTANCES

ID No.	NAME OF MATERIAL	SMALL SPILLS (From a small package or small leak from a large package)				LARGE SPILLS (From a large package or from many small packages)							
		First ISOLATE in all Directions		Then PROTECT persons Downwind during-		First ISOLATE in all Directions		Then PROTECT persons Downwind during-					
		Meters	(Feet)	DAY Kilometers (Miles)	NIGHT Kilometers (Miles)	Meters	(Feet)	DAY Kilometers (Miles)	NIGHT Kilometers (Miles)				
1005	Ammonia, anhydrous	30 m	(100 ft)	0.1 km	(0.1 mi)	0.2 km	(0.1 mi)	150 m	(500 ft)	0.8 km	(0.5 mi)	2.3 km	(1.4 mi)
1005	Anhydrous ammonia												
1008	Boron trifluoride	30 m	(100 ft)	0.1 km	(0.1 mi)	0.6 km	(0.4 mi)	300 m	(1000 ft)	1.9 km	(1.2 mi)	4.8 km	(3.0 mi)
1008	Boron trifluoride, compressed												
1016	Carbon monoxide	30 m	(100 ft)	0.1 km	(0.1 mi)	0.1 km	(0.1 mi)	150 m	(500 ft)	0.7 km	(0.5 mi)	2.7 km	(1.7 mi)
1016	Carbon monoxide, compressed												
1017	Chlorine	60 m	(200 ft)	0.4 km	(0.3 mi)	1.6 km	(1.0 mi)	600 m	(2000 ft)	3.5 km	(2.2 mi)	8.0 km	(5.0 mi)
1023	Coal gas	30 m	(100 ft)	0.1 km	(0.1 mi)	0.1 km	(0.1 mi)	60 m	(200 ft)	0.3 km	(0.2 mi)	0.4 km	(0.3 mi)
1023	Coal gas, compressed												
1026	Cyanogen	30 m	(100 ft)	0.2 km	(0.1 mi)	0.9 km	(0.5 mi)	150 m	(500 ft)	1.0 km	(0.7 mi)	3.5 km	(2.2 mi)
1026	Cyanogen gas												
1040	Ethylene oxide	30 m	(100 ft)	0.1 km	(0.1 mi)	0.2 km	(0.1 mi)	150 m	(500 ft)	0.8 km	(0.5 mi)	2.5 km	(1.6 mi)
1040	Ethylene oxide with Nitrogen												
1045	Fluorine	30 m	(100 ft)	0.1 km	(0.1 mi)	0.3 km	(0.2 mi)	150 m	(500 ft)	0.8 km	(0.5 mi)	3.1 km	(1.9 mi)
1045	Fluorine, compressed												
1048	Hydrogen bromide, anhydrous	30 m	(100 ft)	0.1 km	(0.1 mi)	0.4 km	(0.3 mi)	300 m	(1000 ft)	1.5 km	(1.0 mi)	4.5 km	(2.8 mi)
1050	Hydrogen chloride, anhydrous	30 m	(100 ft)	0.1 km	(0.1 mi)	0.4 km	(0.2 mi)	60 m	(200 ft)	0.3 km	(0.2 mi)	1.4 km	(0.9 mi)
1051	AC (when used as a weapon)	100 m	(300 ft)	0.3 km	(0.2 mi)	1.1 km	(0.7 mi)	1000 m	(3000 ft)	3.8 km	(2.4 mi)	7.2 km	(4.5 mi)
1051	Hydrocyanic acid, aqueous solutions, with more than 20% Hydrogen cyanide	60 m	(200 ft)	0.2 km	(0.1 mi)	0.6 km	(0.4 mi)	400 m	(1250 ft)	1.6 km	(1.0 mi)	4.1 km	(2.5 mi)
1051	Hydrogen cyanide, anhydrous, stabilized												
1051	Hydrogen cyanide, stabilized												
1052	Hydrogen fluoride, anhydrous	30 m	(100 ft)	0.1 km	(0.1 mi)	0.5 km	(0.3 mi)	300 m	(1000 ft)	1.7 km	(1.1 mi)	3.6 km	(2.2 mi)



NFPA 4.2.3(1)

Analyze the Incident

Table 1

TABLE 1 - Initial Isolation and Protective Action Distances

suggests distances useful to protect people from vapours resulting from spills involving dangerous goods that are considered :

- toxic by inhalation (TIH),
- chemical warfare agents and
- materials that produce toxic gases upon contact with water.

In this table, the substances are presented in numerical order of their ID numbers. An asterisk (*) next to the ID number indicates to consult **Table 3** for more information.



TABLE 1 - INITIAL ISOLATION AND PROTECTIVE ACTION DISTANCES

ID No.	Guide	NAME OF MATERIAL	SMALL SPILLS (From a small package or small leak from a large package)					LARGE SPILLS (From a large package or from many small packages)						
			First ISOLATE in all Directions Meters (Feet)		Then PROTECT persons Downwind during-				First ISOLATE in all Directions Meters (Feet)		Then PROTECT persons Downwind during-			
					DAY Kilometers (Miles)		NIGHT Kilometers (Miles)				DAY Kilometers (Miles)		NIGHT Kilometers (Miles)	
1005 *	125	Ammonia, anhydrous	30 m	(100 ft)	0.1 km	(0.1 mi)	0.2 km	(0.1 mi)	150 m	(500 ft)	0.8 km	(0.5 mi)	2.0 km	(1.3 mi)
1005 *	125	Anhydrous ammonia												
1008	125	Boron trifluoride	30 m	(100 ft)	0.1 km	(0.1 mi)	0.5 km	(0.4 mi)	300 m	(1000 ft)	1.7 km	(1.1 mi)	4.8 km	(3.0 mi)
1008	125	Boron trifluoride, compressed												
1016	119	Carbon monoxide	30 m	(100 ft)	0.1 km	(0.1 mi)	0.2 km	(0.1 mi)	200 m	(600 ft)	1.2 km	(0.8 mi)	4.8 km	(3.0 mi)
1016	119	Carbon monoxide, compressed												
1017 *	124	Chlorine	60 m	(200 ft)	0.4 km	(0.2 mi)	1.5 km	(1.0 mi)	500 m	(1500 ft)	3.0 km	(1.9 mi)	7.9 km	(4.9 mi)
1023	119	Coal gas	60 m	(200 ft)	0.2 km	(0.1 mi)	0.2 km	(0.1 mi)	100 m	(300 ft)	0.4 km	(0.2 mi)	0.5 km	(0.3 mi)
1023	119	Coal gas, compressed												
1026	119	Cyanogen	30 m	(100 ft)	0.1 km	(0.1 mi)	0.5 km	(0.3 mi)	60 m	(200 ft)	0.4 km	(0.2 mi)	1.7 km	(1.0 mi)
1026	119	Cyanogen gas												
1040 *	119P	Ethylene oxide	30 m	(100 ft)	0.1 km	(0.1 mi)	0.2 km	(0.1 mi)	150 m	(500 ft)	0.9 km	(0.5 mi)	2.0 km	(1.3 mi)
1040 *	119P	Ethylene oxide with Nitrogen												
1045	124	Fluorine	30 m	(100 ft)	0.1 km	(0.1 mi)	0.2 km	(0.1 mi)	100 m	(300 ft)	0.5 km	(0.3 mi)	2.3 km	(1.4 mi)
1045	124	Fluorine, compressed												
1048	125	Hydrogen bromide, anhydrous	30 m	(100 ft)	0.1 km	(0.1 mi)	0.3 km	(0.2 mi)	200 m	(600 ft)	1.2 km	(0.8 mi)	3.9 km	(2.4 mi)
1050 *	125	Hydrogen chloride, anhydrous	30 m	(100 ft)	0.1 km	(0.1 mi)	0.3 km	(0.2 mi)	60 m	(200 ft)	0.3 km	(0.2 mi)	1.3 km	(0.8 mi)
1051	117	AC (when used as a weapon)	60 m	(200 ft)	0.3 km	(0.2 mi)	1.0 km	(0.6 mi)	1000 m	(3000 ft)	3.7 km	(2.3 mi)	8.4 km	(5.3 mi)

Analyze the Incident

Table 1

This table provides, for small and large spills, the distances for:

- The Initial Isolation Zone and,
- The suggested Protective Action Zone, **downwind**,
for **day** and **night**.

The distances show the areas likely to be affected during the first 30 minutes after the materials are spilled, and this distance could increase with time.

The responders must choose a protective actions: evacuation, shelter in place or a combination of both (see page 288 of the ERG2012).



Analyze the Incident

Small and Large Spills

The definitions are as follow:

- **Small Spill:** A spill that involves quantities that are less than 208 litres (55 U.S. Gallons) for liquids and less than 300 kilograms (660 pounds) for solids. Generally involves a single small package, a small cylinder, or a small leak from a large package.
- **Large Spill:** A spill that involves quantities that are greater than 208 litres (55 U.S. Gallons) for liquids and greater than 300 kilograms (660 pounds) for solids. Generally involves a spill from a large package, or multiple spills from many small packages.

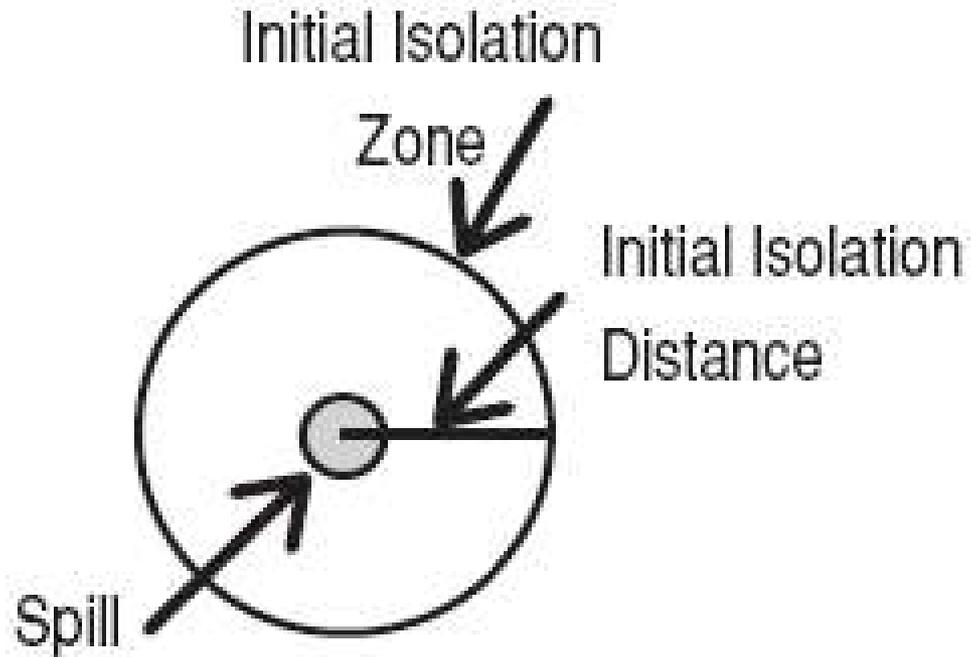
For any intermediate quantity, the distances would need to be estimated between the distances provided for small and large spills.



Analyze the Incident

Initial Isolation Zone

Defines an area **SURROUNDING** the incident in which persons may be exposed to dangerous (upwind) and life threatening (downwind) concentrations of material.



Analyze the Incident

Protective Action Zone

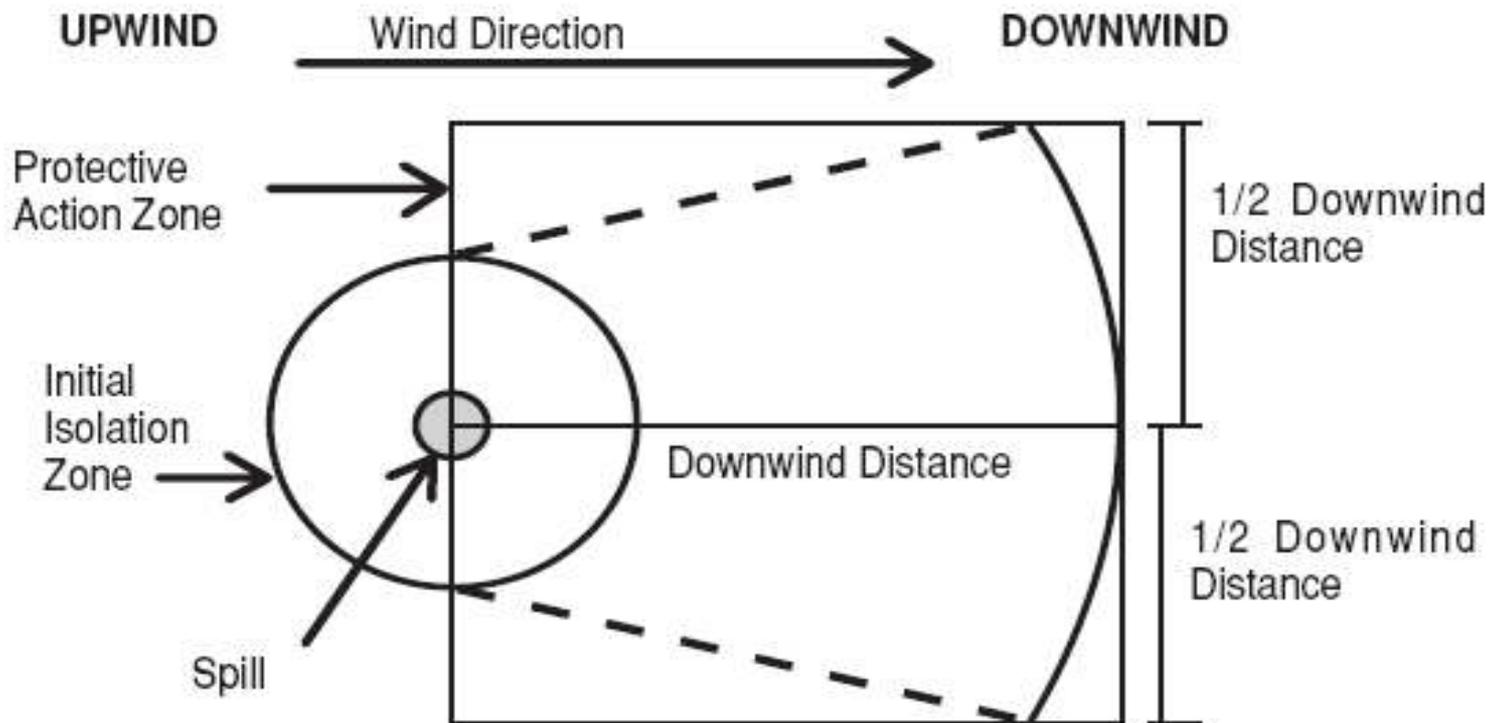
- Defines an area DOWNWIND from the incident in which persons may become incapacitated and unable to take protective action and/or incur serious or irreversible health effects;
- For practical purposes, the Protective Action Zone is a square, whose length and width are the same as the downwind distance shown in **Table 1** (see diagram in the following page);



Analyze the Incident

Protective Action Zone

The shape of the area in which protective should be taken actions (the Protective Action Zone) is shown in the figure below.



Analyze the Incident

Protective Action Zone

It is important to note that Protective Action Zones do not only depend on the mere presence of gases/vapours but mainly on its concentration in the air :

- **During the day**, there is an increase of the atmospheric disturbances creating a greater dispersion (dilution) of the gases/vapours, which results in a weaker toxic concentration in the air and thus requires a smaller Protective Action Zone than at night.
- **During the night**, the gases/vapours will calmly dissipate. This will result in a higher toxic concentration in the air and consequently, necessitate a greater Protective Action Zone.



Analyze the Incident

Table 2

TABLE 2 – Water-Reactive Materials which Produce Toxic Gases contains:

- A list of materials which produce large amount of Toxic Inhalation Hazard (TIH) gases when spilled in water and identifies the TIH gases produced.
- The substances are presented in numerical order of their ID Numbers.

These Water Reactive materials are easily identified in **Table 1** as their name is immediately followed by (*when spilled in water*).



TABLE2 - WATER-REACTIVE MATERIALS WHICH PRODUCE TOXIC GASES

Materials Which Produce Large Amounts of Toxic-by-Inhalation (TIH) Gas(es) When Spilled In Water			
ID No.	Guide No.	Name of Material	TIH Gas(es) Produced
1716	156	Acetyl bromide	HBr
1717	155	Acetyl chloride	HCl
1724	155	Allyltrichlorosilane, stabilized	HCl
1725	137	Aluminum bromide, anhydrous	HBr
1726	137	Aluminum chloride, anhydrous	HCl
1728	155	Amyltrichlorosilane	HCl
1732	157	Antimony pentafluoride	HF
1741	125	Boron trichloride	HCl
1745	144	Bromine pentafluoride	HF Br ₂
1746	144	Bromine trifluoride	HF Br ₂
1747	155	Butyltrichlorosilane	HCl
1752	156	Chloroacetyl chloride	HCl
1753	156	Chlorophenyltrichlorosilane	HCl
1754	137	Chlorosulfonic acid	HCl
1754	137	Chlorosulfonic acid and Sulfur trioxide mixture	HCl
1754	137	Chlorosulphonic acid	HCl
1754	137	Chlorosulphonic acid and Sulphur trioxide mixture	HCl
1754	137	Sulfur trioxide and Chlorosulfonic acid	HCl
1754	137	Sulphur trioxide and Chlorosulphonic acid	HCl
1758	137	Chromium oxychloride	HCl
1762	156	Cyclohexenyltrichlorosilane	HCl
1763	156	Cyclohexyltrichlorosilane	HCl
1765	156	Dichloroacetyl chloride	HCl

Chemical Symbols for TIH Gases:

Br ₂	Bromine	HF	Hydrogen fluoride	NO ₂	Nitrogen dioxide
Cl ₂	Chlorine	HI	Hydrogen iodide	PH ₃	Phosphine
HBr	Hydrogen bromide	H ₂ S	Hydrogen sulfide	SO ₂	Sulfur dioxide
HCl	Hydrogen chloride	H ₂ S	Hydrogen sulphide	SO ₂	Sulphur dioxide
HCN	Hydrogen cyanide	NH ₃	Ammonia		

TABLE2 - WATER-REACTIVE MATERIALS WHICH PRODUCE TOXIC GASES

Materials Which Produce Large Amounts of Toxic-by-Inhalation (TIH) Gas(es) When Spilled In Water			
ID No.	Guide No.	Name of Material	TIH Gas(es) Produced
1766	156	Dichlorophenyltrichlorosilane	HCl
1767	155	Diethyldichlorosilane	HCl
1769	156	Diphenyldichlorosilane	HCl
1771	156	Dodecyltrichlorosilane	HCl
1777	137	Fluorosulfonic acid	HF
1777	137	Fluorosulphonic acid	HF
1781	156	Hexadecyltrichlorosilane	HCl
1784	156	Hexyltrichlorosilane	HCl
1799	156	Nonyltrichlorosilane	HCl
1800	156	Octadecyltrichlorosilane	HCl
1801	156	Octyltrichlorosilane	HCl
1804	156	Phenyltrichlorosilane	HCl
1806	137	Phosphorus pentachloride	HCl
1808	137	Phosphorus tribromide	HBr
1809	137	Phosphorus trichloride	HCl
1810	137	Phosphorus oxychloride	HCl
1815	132	Propionyl chloride	HCl
1816	155	Propyltrichlorosilane	HCl
1818	157	Silicon tetrachloride	HCl
1828	137	Sulfur chlorides	HCl SO ₂ H ₂ S
1828	137	Sulphur chlorides	HCl SO ₂ H ₂ S
1834	137	Sulfuryl chloride	HCl
1834	137	Sulphuryl chloride	HCl

Chemical Symbols for TIH Gases:

Br ₂	Bromine	HF	Hydrogen fluoride	NO ₂	Nitrogen dioxide
Cl ₂	Chlorine	HI	Hydrogen iodide	PH ₃	Phosphine
HBr	Hydrogen bromide	H ₂ S	Hydrogen sulfide	SO ₂	Sulfur dioxide
HCl	Hydrogen chloride	H ₂ S	Hydrogen sulphide	SO ₂	Sulphur dioxide
HCN	Hydrogen cyanide	NH ₃	Ammonia		

Analyze the Incident

Table 2

Important:

- Some Water Reactive materials are also TIH materials themselves (e.g., Bromine trifluoride (ID No. 1746)). In these instances, two entries are provided in **Table 1**:
 - One for *when spilled on land* and,
 - The other for *when spilled in water*.
- If the Water Reactive material is NOT a TIH and this material is NOT spilled in water, **Table 1** and **Table 2** do not apply and safety distances will be found within the appropriate **ORANGE** guide.



Analyze the Incident

Table 3

TABLE 3 – Initial Isolation and Protective Action Distances for Different Quantities of Six Common TIH Gases:

- A list of Toxic Inhalation Hazard materials that may be more commonly encountered.
- The materials are:
 - Ammonia, anhydrous (UN1005)
 - Chlorine (UN1017)
 - Ethylene oxide (UN1040)
 - Hydrogen chloride, anhydrous (UN1050) and Hydrogen chloride, refrigerated liquid (UN2186)
 - Hydrogen fluoride, anhydrous (UN1052)
 - Sulfur dioxide / Sulphur dioxide (UN1079)



Analyze the Incident

Table 3

Important:

The materials are presented in alphabetical order and provide initial isolation and protective action distances for large spills (more than 208 litres or 55 US gallons) involving different container types (therefore different volume capacities) for day time and night time situations and different wind speeds.



TABLE 3 - INITIAL ISOLATION AND PROTECTIVE ACTION DISTANCES FOR DIFFERENT QUANTITIES OF SIX COMMON TIH GASES

TRANSPORT CONTAINER	UN 1005 Ammonia, anhydrous: Large Spills													
	First ISOLATE in all Directions		Then PROTECT persons Downwind during											
			DAY						NIGHT					
			Low wind (< 6 mph = < 10 km/h)		Moderate wind (6-12 mph = 10 - 20 km/h)		High wind (> 12 mph = > 20 km/h)		Low wind (< 6 mph = < 10 km/h)		Moderate wind (6-12 mph = 10 - 20 km/h)		High wind (> 12 mph = > 20 km/h)	
Meters	(Feet)	Km	(Miles)	Km	(Miles)	Km	(Miles)	Km	(Miles)	Km	(Miles)	Km	(Miles)	
Rail tank car	300	(1000)	2.3	(1.4)	1.3	(0.8)	1.0	(0.6)	6.3	(3.9)	2.6	(1.6)	1.3	(0.8)
Highway tank truck or trailer	125	(400)	1.0	(0.6)	0.5	(0.3)	0.3	(0.2)	2.6	(1.6)	0.8	(0.5)	0.5	(0.3)
Agricultural nurse tank	60	(200)	0.6	(0.4)	0.3	(0.2)	0.3	(0.2)	1.5	(0.9)	0.5	(0.3)	0.3	(0.2)
Multiple small cylinders	30	(100)	0.3	(0.2)	0.1	(0.1)	0.1	(0.1)	0.8	(0.5)	0.3	(0.2)	0.1	(0.1)
TRANSPORT CONTAINER	UN 1017 Chlorine: Large Spills													
Rail tank car	1000	(3000)	11+	(7+)	9.0	(5.6)	5.5	(3.4)	11+	(7+)	11+	(7+)	7.1	(4.4)
Highway tank truck or trailer	1000	(3000)	6.0	(6.6)	3.5	(2.2)	2.9	(1.8)	11+	(7+)	5.5	(3.4)	4.2	(2.6)
Multiple ton cylinders	400	(1250)	4.0	(2.5)	1.5	(0.9)	1.1	(0.7)	7.9	(4.9)	2.7	(1.7)	1.5	(0.9)
Multiple small cylinders or single ton cylinder	250	(800)	2.6	(1.6)	1.0	(0.6)	0.8	(0.5)	5.6	(3.5)	1.8	(1.1)	0.8	(0.5)

"+" means distance can be larger in certain atmospheric conditions



Table of Placards

- **Placards – Table of Placards**
- **Dealing with:**
 - **Mixed Load**
 - **Unidentified Cargo**
 - 1 Guide 111**
 - 2 Dangerous Placard**



NFPA 4.2.3(1)



TABLE OF MARKINGS, LABELS, AND PLACARDS
 USE ONLY IF MATERIALS CANNOT BE SPECIFICALLY IDENTIFIED BY

AND INITIAL RESPONSE GUIDE TO USE ON-SCENE
 USING THE SHIPPING DOCUMENT, NUMBERED PLACARD, OR ORANGE PANEL NUMBER



111

DANGER
DANGEROUS
Y
Air Only
Air Other Modes

112

EXPLOSIVES
1.5 BLASTING AGENTS

For Divisions 1.1, 1.2, 1.3 and 1.5, enter division number (**) and compatibility group letter (*), when required.

134

FLAMMABLE SOLID

136

SPONTANEOUSLY COMBUSTIBLE

139

DANGEROUS WHEN WET

114

1.4 EXPLOSIVES
1.6 EXPLOSIVES

For Divisions 1.4 and 1.6, enter compatibility group letter (*), when required.

118

FLAMMABLE GAS

143

OXIDIZER

148

ORGANIC PEROXIDE

153

TOXIC
POISON
INHALATION HAZARD

123

INHALATION HAZARD

122

OXYGEN

158

INFECTIOUS SUBSTANCE
INFECTIOUS INFECTIOUS

UN3373

163

RADIOACTIVE
RADIOACTIVE I
RADIOACTIVE II
RADIOACTIVE III
FISSILE

153

CORROSIVE

121

NON-FLAMMABLE GAS

125

1005

128

FUEL OIL
HOT

171

MARINE POLLUTANT



Rail Car and Road Trailer Identification Chart

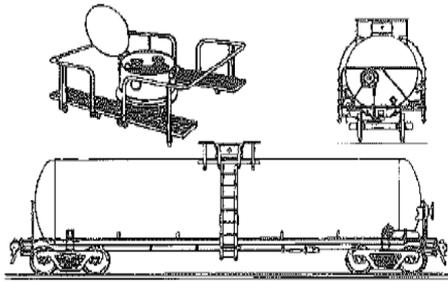
- **Used as Last Resort**
- **Used Only for the Rail and Highway Modes of Transportation**



NFPA 4.2.3(1)

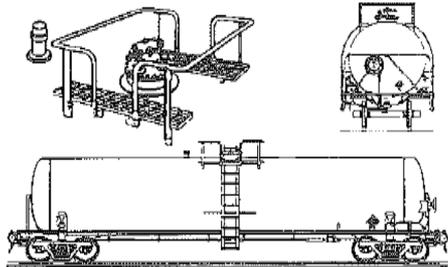
CONNECTICUT FIRE ACADEMY

117 Pressure tank car



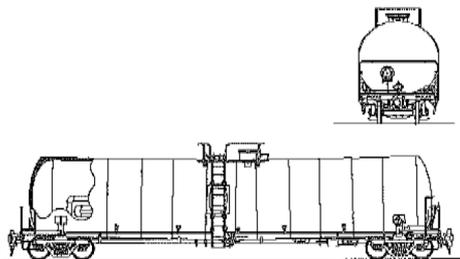
- For flammable, non-flammable, toxic and/or liquefied compressed gases
- Protective housing
- No bottom fittings
- Pressures usually above 40 psi

131 General service tank car (low pressure)



- For variety of hazardous and non-hazardous materials
- Fittings and valves normally visible at the top of the tank
- Some may have bottom outlet valve
- Pressures usually below 25 psi

128 Low pressure tank car (TC117, DOT117)



(Image provided as a courtesy of The Greenbrier Companies, Inc.)

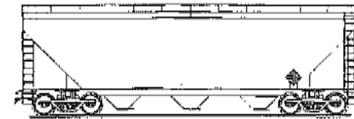
- For flammable liquids (e.g., Petroleum crude oil, ethanol)
- Protective housing separate from manway
- Bottom outlet valve
- Pressures usually below 25 psi

111 Box car

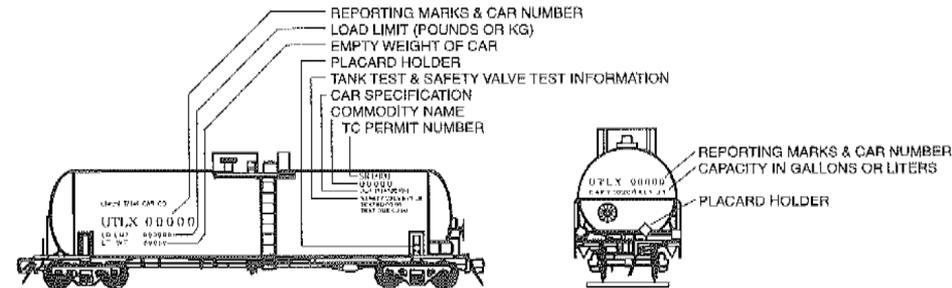


- For general freight that carry bulk or non-bulk packages
- May transport hazardous materials in small packages or "tote bins"
- Single or double sliding door

140 Hopper car



- For bulk commodities and bulk cargo (e.g., coal, ore, cement and solid granular materials)
- Bulk lading discharged by gravity through the hopper bottom doors when doors opened



CAUTION: Emergency response personnel must be aware that rail tank cars vary widely in construction, fittings and purpose. Tank cars could transport products that may be solids, liquids or gases. The products may be under pressure. It is essential that products be identified by consulting shipping documents or train consist or contacting dispatch centers before emergency response is initiated.

The information stenciled on the sides or ends of tank cars, as illustrated above, may be used to identify the product utilizing:

- the commodity name shown; or
- the other information shown, especially reporting marks and car number which, when supplied to a dispatch center, will facilitate the identification of the product.

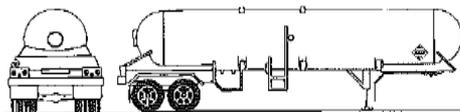
* The recommended guides should be considered as last resort if the material cannot be identified by any other means.

ROAD TRAILER IDENTIFICATION CHART*

WARNING: Road trailers may be jacketed, the cross-section may look different than shown and external ring stiffeners would be invisible.

NOTE: An emergency shut-off valve is commonly found at the front of the tank, near the driver door.

117 MC331, TC331, SCT331



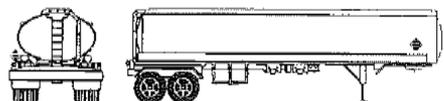
- For liquefied compressed gases (e.g., LPG, ammonia)
- Rounded heads
- Design pressure between 100-500 psi**

117 MC338, TC338, SCT338, TC341, CGA341



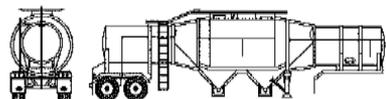
- For refrigerated liquefied gases (cryogenic liquids)
- Similar to a "giant thermo-bottle"
- Fitting compartments located in a cabinet at the rear of the tank
- MAWP between 25-500 psi**

131 DOT406, TC406, SCT306, MC306, TC306



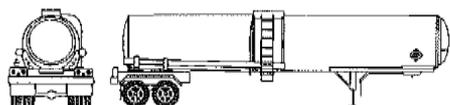
- For flammable liquids (e.g., gasoline, diesel)
- Elliptical cross-section
- Rollover protection at the top
- Bottom outlet valves
- MAWP between 3-15 psi**

112 TC423



- For emulsion and water-gel explosives
- Hopper-style configuration
- MAWP between 5-15 psi**

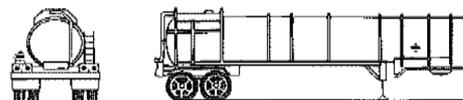
137 DOT407, TC407, SCT307, MC307, TC307



- For toxic, corrosive, and flammable liquids
- Circular cross-section
- May have external ring stiffeners
- MAWP of at least 25 psi**

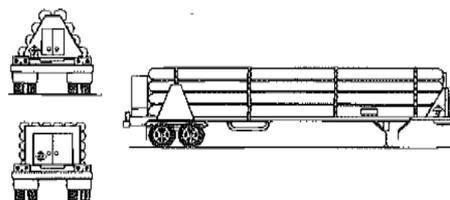
ROAD TRAILER IDENTIFICATION CHART*

137 DOT412, TC412, SCT312, MC312, TC312

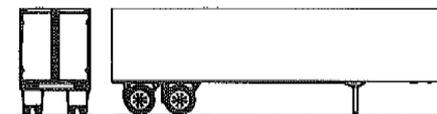


- Usually for corrosive liquids
- Circular cross-section
- External ring stiffeners
- Tank diameter is relatively small
- MAWP of at least 15 psi**

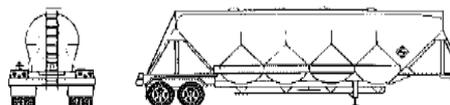
117 Compressed Gas/Tube Trailer



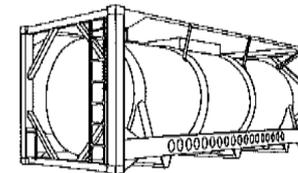
111 Mixed Cargo



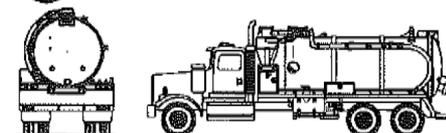
134 Dry Bulk Cargo Trailer



117 Intermodal Tank



137 Vacuum Tanker



CAUTION: This chart depicts only the most general shapes of road trailers. Emergency response personnel must be aware that there are many variations of road trailers, not illustrated above, that are used for shipping chemical products. The suggested guides are for the most hazardous products that may be transported in these trailer types.

* The recommended guides should be considered as last resort if the material cannot be identified by any other means.

** MAWP: Maximum Allowable Working Pressure.

**GLOBALLY HARMONIZED SYSTEM OF CLASSIFICATION
AND LABELING OF CHEMICALS (GHS)**

(May be found on means of containment during transport)

The Globally Harmonized System of Classification and Labeling of Chemicals (GHS) is an international guideline published by the United Nations. The GHS aims to harmonize the classification and labeling systems for all sectors involved in the life cycle of a chemical (production, storage, transport, workplace use, consumer use and presence in the environment).

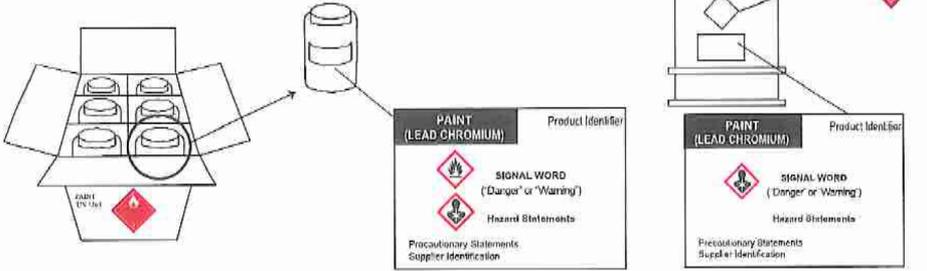
The GHS has nine symbols used to convey specific physical, health and environmental hazard information. These symbols are part of a pictogram that is diamond shaped and includes the GHS symbol in black on a white background with a red frame. The pictogram is part of the GHS label, which also includes the following information:

- Signal word
- Hazard statement
- Precautionary statements
- Product identifier
- Supplier identification

GHS pictograms are similar in shape to transport labels; however, transport labels have backgrounds of different colors.

The elements of the GHS that address signal words and hazard statements are not expected to be adopted in the transport sector. For substances and mixtures covered by the UN Recommendations on the Transport of Dangerous Goods, Model Regulations, the transport labels for physical hazards will have precedence. In transport, a GHS pictogram for the same (or lesser) hazard as the one reflected by the transport label or placard should not be present, but it could exist on the package.

Examples of GHS labeling:



Outer Packaging: Box with flammable liquid transport label

Inner Packaging: Plastic bottle with GHS hazard warning label

Single Packaging: 200 L (55 US gallons) drum with a flammable liquid transport label combined with GHS hazard warning label

In some cases, such as on drums or international bulk containers (IBCs), which must address information for all sectors, the GHS label may be found in addition to the required transport labels and placards. Both types of labels (GHS and transport) will differ in a way that will make them easy to identify during an emergency.

GHS Pictograms	Physical hazards	GHS Pictograms	Health and Environmental hazards
	Explosive; Self-reactive; Organic peroxide		Skin corrosion; Serious eye damage
	Flammable; Pyrophoric; Self-reactive; Organic peroxide; Self-heating; Emits flammable gases when in contact with water		Acute toxicity (harmful); Skin sensitizer; Irritant (skin and eye); Narcotic effect; Respiratory tract irritant; Hazardous to ozone layer (environment)
	Oxidizer		Respiratory sensitizer; Mutagen; Carcinogen; Reproductive toxicity; Target organ toxicity; Aspiration hazard
	Gas under pressure		Hazardous to aquatic environment
	Corrosive to metals		Acute toxicity (fatal or toxic)