12. COMMERCIAL TRANSPORTATION AND STORAGE

- ***H&SC §12105 (Storage of hazardous waste)***
- ***1996 North American Emergency Response Guidebook***
- ***UFC Article 82, Section 82.105(d) and Section 82.111***

Commercial transportation, commonly by truck, is a large industry in many wildland areas. Supplies and consumer products are delivered, raw materials taken to processing plants, and finished products hauled to markets. Most of the commodities represent little or no fire hazard; some are very dangerous. The vehicles used represent one of the highest fire risks present in the wildlands (see the chapter on Motor Vehicle Operation and Maintenance). Some vehicle operators are also serious fire risks (i.e., smoking and driving habits, lack of knowledge regarding cargoes and firefighting, etc.).

Associated with much of the transportation activity are storage and distribution facilities (e.g., warehouses, bulk petroleum plants, explosives magazines, or LPG distributors). A number of products involved, and their chemical or physical properties related to fire, are unknown to local firefighters. Often bills-of-lading do not provide adequate information to either the driver or firefighters about the nature of the cargo.

The subject of hazardous materials occupies a full semester course in fire science curricula; only a few highlights can be presented here. There are three major kinds of hazards to be aware of and protected against: 1) violent rupture potential, 2) explosive, and 3) toxic. The smoke or fumes of any of these should be avoided or protected against with a self-contained breathing apparatus and/or protective clothing.

Loads containing more than 100 pounds of a hazardous material (or with some types, 1000 pounds) are required to be identified with placards. The placards are diamond-shaped and of various colors. The categories are:

- explosives
- gases (flammable and non-flammable)
- flammable liquids (and combustible liquids [US])
- flammable solids
- oxidizers and organic peroxides
- toxic (poison) materials and infectious substances
- radio-active materials
- corrosives
- miscellaneous dangerous goods

All flammable gases have violent rupture potential (VRP). Some are also toxic (e.g., carbon monoxide, hydrogen sulfide, and vinyl chloride). Flammable gases commonly transported in wildland areas include liquefied petroleum gas (LPG), propane, and vinyl chloride. Any of them will usually ignite if a rupture or serious leak in the container occurs. If not, it will form a gas cloud that is easily ignited.

The proper fire suppression technique is to stop the flow of gas by closing a valve. If this is not possible, allow the gas to completely burn while keeping the container cool with water. Tanks containing flammable gases that are exposed to intense heat are likely to rupture violently and engulf the immediate area in a large fireball. When tanks are thus exposed, consider initial downwind evacuation for at least one-half mile.

The most fire-hazardous operation with LPG is during, and immediately following, transfer from one tank to another. Transfers occur at bulk plants, both incoming and outgoing, and at points of use, residential and commercial. This operation takes place thousands of times each day because LPG is so widely used outside of metropolitan areas served by natural gas. Leaks can happen from cracked, broken or poorly connected fittings, ruptured hoses, and human error, such as failing to disconnect before driving away. Ignitions can occur from any of a number of sources, which may or may not be associated with the transfer operation itself since escaping gas will travel and often find a heat source.

Another fire hazard with LPG is the threat of overheating and rupture of containers, pipes and fittings by wildfires. All LPG containers, whether at bulk plants or at points of use, should be well protected from this danger by adequate clearance of dry grass, brush and unlimbed trees for at least 10 feet in all directions. They should also be separated from each other and from buildings depending on their size: Less than 100 gallons is five feet, 100 to 500 gallons is 10 feet, 500 to1200 gallons is twenty five feet, and over 1200 gallons is 50 feet (U.F.C. Article 82, Section 82.105 [d]).

There are three groups of explosives: primary or initiating high explosives, secondary high explosives, and low explosives. Primary or initiating high explosives are easily detonated by applying small amounts of heat, mechanical shock, or pressure. Their chief function is to initiate detonations in secondary high explosives. The major ingredients in primary explosives include but are not limited to lead azide, lead styphnate, and mercury fulminate. Electric blasting caps and detonating cord delay connectors are both examples of primary high explosives.

Secondary high explosives are much less sensitive to heat and mechanical shock, but are considerably more powerful than primary explosives. Secondary explosives are usually detonated by use of primary explosives. Products such as TNT, nitroglycerin, and dynamite are considered to be secondary high explosives and can be found in commercial blasting and military operations.

Low explosives or propellants usually operate by deflagration (rapid burning) rather than by detonation. Major propellants include such materials as solid rocket fuels, black powder, and smokeless powder. Under the proper conditions, some low explosives may detonate.

Poisons are divided into two categories, A and B. All are very toxic and many have VRP. Poisons A are gases and are extremely toxic. They must be avoided by all personnel except specialists with protective clothing and breathing apparatus. If leaking, personnel should be evacuated as far as necessary to avoid any contact. Examples of these materials include nitric oxide, parathion gas (VRP), organic phosphates and phosgene (VRP).

Poisons B are mostly liquids or solids. Continued contact, inhalation or ingestion can cause illness or death. Try to prevent spread by constructing dykes, berms or dams. Examples include cyanide (dry), parathion (liquid or dry), tetraethyl lead (VRP), and chlorine (VRP).

Figure 12-1.
Common Hazardous Materials Placards

Flammable liquids (placarded "Flammable") are all toxic and most have VRP. They give off flammable vapors when spilled which will ignite upon contact with an open flame, spark or hot surface. The vapors are usually heavier than air and will flow downhill and into depressions. Common examples are gasoline, benzene, ether, alcohol, and vinyl acetate. When containers are involved in a fire, personnel should be evacuated one-half mile. All sources of ignition (e.g., smoking, internal combustion engines, or welding) should be eliminated from the area where the vapors are expected to flow.

Nonflammable gases have VRP and many are toxic. Numerous also exclude oxygen and therefore can cause asphyxiation. Gas clouds are not always visible and some have no odor. If containers are exposed to intense heat, personnel should be evacuated for one-half mile. Examples include anhydrous ammonia, hydrogen chloride, and nitrous oxide. Chlorine is classed as both a Poison and Nonflammable Gas and is both toxic and VRP.

Flammable solids can cause fires by self-ignition or spontaneous combustion if exposed to proper conditions (e.g., getting wet, being crushed, and contact with corrosives). Some have VRP. The most dangerous to firefighters are those bearing a white crossed-out W on a blue triangle in the upper portion of the placard. This symbol means "dangerous when wet." Avoid use of water in fire suppression operations near these materials. Examples include calcium carbide, magnesium, potassium, and sodium.

Oxidizers release oxygen when heated and thus greatly stimulate combustion of other fuels. All have VRP. Some, if mixed with petroleum products, become explosive (e.g., ammonium nitrate). If these materials become involved in fires, personnel should be evacuated for one-half mile. Examples include hydrogen peroxide, calcium chlorate, potassium perchlorate, and urea peroxide.

Corrosives are all toxic. Contact with any of them can cause serious eye, skin or respiratory injury. Their fumes are usually just as toxic as the liquid and must be avoided by unprotected personnel. Since mixing with other chemicals can cause fire or explosion, spills should be contained as quickly as possible. Examples include hydrochloric acid, sulfuric acid, and caustic soda.

Combustible liquids (placarded "Combustible") which have a flash point greater than 60.5º C (141º F) and below 93º C. (200º F) can burn when heated. If spilled they will extend and complicate an existing fire (e.g., truck wreck). Examples include diesel fuel, anti-freeze compound, and cut-back asphalt.

Radioactive materials are all toxic. If a spill occurs, personnel should be evacuated for at least 330 feet and, in the case of a fire, for at least 1000 feet. All personnel should be evacuated for one-quarter mile until the area is monitored and declared safe by specialists. If smoke clouds drift, personnel should be kept well clear of the smoke.

All firefighters and anyone involved in transporting any of these hazardous materials should learn all they can about said materials and keep themselves continuously updated. New materials are constantly being developed for agriculture and industry, many of which are hazardous in one way or another. Some, although common, present hazards in unusual ways that are known to only a few.

One of these is chloral hydrate, which is used in large quantities by paper mills. It is usually transported as a liquid, which is relatively inert, though toxic. However, when it is spilled, as in a wreck, it dries into a crystalline form which is extremely flammable when exposed to abrasion. The clothing of firefighters and plant workers has been known to burst into flame by the simple act of walking after having chloral hydrate spilled on it and then drying out. Leather-soled shoes have produced similar results. Emergency information concerning specific materials can be obtained by telephoning Chemtrec (800) 424-9300.