Handling of Hydrocarbon Fluids

Learning Outcome
When you complete this module you will be able to:

Describe the safety procedures for the loading, storage, unloading and transportation of hydrocarbon fluids.

Learning Objectives
Here is what you will be able to do when you complete each objective:

1. Describe the significant properties of the most common hydrocarbon fluids.

2. Describe the sources of ignition for a hydrocarbon.

3. Explain the safety requirements for the loading, unloading, and transportation of hydrocarbon fluids.

4. Describe the general safety issues associated with the storage and gauging of hydrocarbon liquids.
INTRODUCTION

To safely handle hydrocarbons it is necessary to know their properties. This module will deal only with the properties that are important to persons responsible for the loading, unloading, storage and transportation of hydrocarbon fluids.

NOTE: In the Appendix at the end of this module is a pertinent Bulletin from Alberta Occupational Health and Safety. You must read this bulletin carefully as a supplement to this module.

FLAMMABLE, OR EXPLOSIVE, LIMITS

Gaseous fuels will mix with air in all proportions, but the proportions must be within certain limits before the mixtures will ignite. These limits are called the flammable, or explosive, limits.

By definition, a flammable limit is the percentage of the fuel, by volume, in the air/fuel mixture. The flammable range occurs between the lower flammable limit and the upper flammable limit. Fuel/air mixtures outside of the flammable range will not burn or explode. The flammable limits of some hydrocarbons are listed in Table 1.

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Flammable Limits in Air, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td>Methane</td>
<td>5.0</td>
</tr>
<tr>
<td>Propane</td>
<td>2.2</td>
</tr>
<tr>
<td>Butane</td>
<td>1.9</td>
</tr>
<tr>
<td>Natural gasoline</td>
<td>1.1</td>
</tr>
<tr>
<td>Kerosene</td>
<td>0.7</td>
</tr>
<tr>
<td>Hydrogen sulphide</td>
<td>4.3</td>
</tr>
</tbody>
</table>

Table 1
Flammable Limits

When the percentage of fuel is lower than the lower flammable limit, the mixture is described as being “lean”. When the percentage of fuel is greater than the upper flammable limit, the mixture is described as being “rich”.

The flammable range for a hydrocarbon is much wider in oxygen than it is in air. For example, from Table 1, the flammable range for a propane/oxygen mixture is 2.2% to 57%, compared to a range of 2.2% to 9.5% for a propane/air mixture.
The flammable ranges listed in Table 1 are correct only at atmospheric pressure and normal ambient temperature. The flammable range is wider at higher pressures and/or temperatures.

When dealing with mixtures of hydrocarbons, it is wise to assume that the mixture will have the properties of the more hazardous component. For example, a mixture of gasoline and kerosene will exhibit the fire hazard properties of gasoline. In actual practice, great care must be taken when using values from Table 1, since a substantial safety factor must be used to compensate for inevitable errors in sampling.

For combustion to occur, there must be a fuel/air mixture within the flammable limits. The fuel must be in the vapor state or in a very finely divided state. If the fuel is heated to a temperature at which vapors are produced, it is at or above its “flash point”.

**FLASH POINT**

The flash point of a liquid is the lowest temperature at which enough vapors are given off to form a flammable mixture of vapor and air immediately above the liquid surface. The lighter hydrocarbons are gases at room temperatures, and as such are above their flash point. It must be remembered that hydrocarbons will not burn until changed from the liquid state to the vapor state (see Fig. 1).
The following table gives the flash points of some liquid hydrocarbons.

<table>
<thead>
<tr>
<th>Hydrocarbon</th>
<th>Flash Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butane</td>
<td>-60°C</td>
</tr>
<tr>
<td>Gasoline</td>
<td>-45°C</td>
</tr>
<tr>
<td>2-D diesel fuel</td>
<td>58°C</td>
</tr>
<tr>
<td>Kerosene</td>
<td>49°C</td>
</tr>
<tr>
<td>Denatured alcohol</td>
<td>21°C</td>
</tr>
</tbody>
</table>

*Table 2  
Flash Points*

**Ignition Temperature**

The ignition temperature is the lowest temperature at which a fuel/air mixture will burn or explode. The ignition temperatures of some hydrocarbons are listed in Table 3.

<table>
<thead>
<tr>
<th>Hydrocarbon</th>
<th>Ignition Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>650°C</td>
</tr>
<tr>
<td>Propane</td>
<td>490°C</td>
</tr>
<tr>
<td>Natural gasoline</td>
<td>480°C</td>
</tr>
<tr>
<td>Kerosene</td>
<td>295°C</td>
</tr>
<tr>
<td>Fuel oil</td>
<td>340°C</td>
</tr>
<tr>
<td>Hydrogen sulphide</td>
<td>260°C</td>
</tr>
</tbody>
</table>

*Table 3  
Ignition Temperatures*

A high ignition temperature does not mean that a liquid hydrocarbon is safe. The temperatures of common ignition sources can be extremely high. For example, the flame of a match can be at a temperature of approximately 870°C, and the temperature of an electric arc can be over 5000°C.

It is very important to remember that a fuel/air mixture within the flammable range will ignite if the temperature of the mixture is raised above the ignition temperature. For example, a kerosene/air mixture will ignite without a spark or flame if its temperature is increased beyond 295°C.
SOURCES OF IGNITION

When fuel vapors mix with air in the correct proportions, the resulting flammable mixture could be ignited by one of many ignition sources which are present in the workplace.

Some obvious sources of heat in or around a workplace are:

1. Welding operations
2. Cutting with oxygen acetylene
3. Hot lines (steam, etc.)
4. Furnaces
5. Friction
6. Overheated bearings
7. Engine ignition systems
8. Sparks from electrical equipment
9. Cigarettes and matches
10. Lightning

The following sources of ignition may not be readily recognized:

1. Pyrophoric iron sulphide
2. Static electricity
3. Autoignition
4. Catalytic effect of fresh metallic surfaces

Iron sulphide is the product of a chemical reaction involving iron and hydrogen sulphide. Iron sulphide is brown or black in color, and may appear grainy, scaly, lumpy or powdered. It can be in a mixture with coke, oil, sand etc. If it is allowed to dry out, it will burst into flame in the presence of air. Thus, it must be kept wet to prevent it from igniting.

Static electricity is present wherever materials are in motion and in contact with other material; such as when hydrocarbons move through piping, filters, etc.

Autoignition occurs when the temperature of a fuel/air mixture is raised above its ignition temperature, and ignition will result without a spark or flame.

The fact that the catalytic effect of fresh metallic surfaces can cause ignition has been proven under laboratory conditions. This could explain why several explosions of flammable mixtures have occurred at the exact time that valves were being opened.
It is important to ensure that none of the possible ignition sources are present in hazardous areas. Ignition sources are so numerous that extreme care must be taken at all times to prevent fires from occurring.

THE FIRE TRIANGLE

The combustion process is often described using the fire triangle, as shown in Fig. 2. The three sides represent fuel, oxygen, and a source of ignition, respectively. A fire or explosion can only occur when all three are present. To be absolutely safe, fuel and air should only be mixed under strictly controlled conditions, since there are so many sources of ignition.

Consider how a very small amount of oxygen in a propane stream can cause a flammable mixture. When the propane is transferred to storage some of the propane vaporizes above the liquid and, along with the propane vapor, the oxygen leaves the liquid. The vapor contains a much higher concentration of oxygen than does the liquid. If the tank is further filled the propane will return to the liquid state, but the oxygen becomes more concentrated because of the compression. Eventually, the vapor space can become small enough that the mixture can be within flammable limits.

Since it is difficult, if not impossible, to eliminate all sources of ignition, and since the product being considered is hydrocarbon liquid, every effort must be made to prevent oxygen from coming in contact with hydrocarbon vapors.
LOADING AND UNLOADING HYDROCARBON FLUIDS

Transferring Liquids From One Container To Another

Before pouring a flammable liquid from a dispensing container to a receiving container, the containers must be bonded together to ensure a good electrical contact between the containers. This is done because a potential difference can be produced between the exteriors of the containers when a flammable substance is poured from one container to the other. A static spark “jumping” across the gap between the containers could result in a fire or explosion.

Loading Tank Cars and Tank Trucks with Hydrocarbon Liquids

Liquids such as kerosene, diesel fuel, fuel oil and lubricating oil, when in tank cars or trucks, may not present a hazard because they have a high flash point. But suppose the liquid which was previously in the tank had a low flash point. Gasoline, for example, could have been in a certain tank. The tank would be full of vapors from the gasoline, and the vapors would be too rich to burn. A high flash point product, such as diesel fuel, being loaded, will absorb some of the rich vapors from the gasoline, and air will enter the tank to replace the gasoline vapor. The vapor space can now contain a flammable mixture, because it is no longer too rich to burn. Combine this with the fact that highly refined products having a high flash point are excellent generators of static electricity, and an explosion could easily occur.

The loading of a product having a high flash point after a load of product having a low flash point, sometimes called a high proportion of switch loading, is the principal factor in loading rack fires.

Loading Procedures

Loading procedures specified for each site must be followed. The following list covers some of the common procedures.

1. Before a railway car is loaded, the hand brake must be applied and the wheels chocked. Other site-specific laws required by the Transport Commission, such as installing flags on the track and engaging derails, must also be observed. Transport trucks must have all sources of ignition shut off, the brakes applied, and the wheels chocked.

2. The tank car or tank truck must be suitable for the product which will be loaded. If it is necessary to flush the tank, the washing steam should enter the tank slowly to reduce the risk of a spark from static electricity.
3. The loading-rack grounding connections must be in good condition. This item should be on a preventive maintenance list. The grounding conductors can be easily checked with an ohmmeter.

4. Trucks must be grounded immediately after being placed in position at the loading-rack, and before the loading spout is inserted. This connection eliminates any potential charge between the truck and the loading-rack, but it does not eliminate the possibility of a spark discharge from the liquid surface in the tank.

5. The compartments must be inspected to ensure they are completely drained, if the product to be loaded is different from the previous load. Any loose foreign objects must be removed, as these could become spark promoters during the loading operation.

6. To prevent “switch loading” accidents, the tank compartments should be purged with CO$_2$ or reduction equipment should be used to remove low flash point vapors before loading high flash point liquids. Switch loading is responsible for 90% of loading-rack truck fires.

7. The top-entering loading spout is extended to the bottom of the tank being loaded, as shown in Fig. 3.

![Figure 3
Loading Spout](image)

8. A proper deflector should be installed on the loading spout to prevent the spout from being thrown out, and to prevent splashing and spraying which generates mists and helps to produce static electricity. A tee fitting installed on the end of the spout is not satisfactory because it produces splashing and spraying. Refer to Fig. 3.
9. After loading a tank, a delay of one minute must be observed before withdrawing the spout. This delay allows the static charge on the surface of the liquid to be reduced. A spark from the liquid surface to the spout could be a source of ignition.

10. During loading, or for at least one minute after loading, samples must not be obtained via the top opening. This is required because a spark between the liquid surface and the sample dipper could occur, possibly causing an explosion.

HANDLING LIQUEFIED PETROLEUM GAS (LPG)

LPG must be stored and transported under pressure; therefore, proper procedures and proper equipment must be used. The laws for the transportation of LPG are strictly enforced by Federal and Provincial Transportation Departments.

Loading

Several important fundamentals for safe loading and unloading of LPG products are common to both trucks and rail cars. Before handling LPG, loaders should be aware of the following:

1. Every effort should be made to ensure that no truck or tank car containing air is ever loaded with LPG. To ensure that the tank to be loaded contains no air, a sample of vapor must be checked for oxygen content, using a portable oxygen analyzer. No LPG should be loaded until an acceptable oxygen level is present.

2. Containers must be designed for the particular type of LPG product to be transported. For example, propane, which has a higher vapor pressure than butane, should never be transported in a container designed strictly for butane.

3. Before loading, a check should be made to ensure liquids from a previous load are not present. If liquids are present, they must be identified as acceptable or they must be removed.

4. An LPG container should never be completely filled. If the temperature of the contents of a full container rises during transit, the relief valve will open due to pressure build up caused by liquid expansion, and liquid product will be released. Very little liquid has to be released to create a very large cloud of vapor. The space left above the surface of the liquid is called an “outage”. Check the liquid level frequently while loading to ensure that the tank car or tank truck is not overfilled.
5. Outages left in LPG containers must conform to local regulations. Outages must be carefully calculated from information given by the tank car manufacturer concerning the volume of the tank car. The temperature and relative density of the loaded product must also be considered when calculating the outage. Accurate outage calculations must be made to take full advantage of the maximum carrying capacity of the car, and to still leave a vapor space for liquid expansion. Records of outage calculations must be kept.

6. Loading hoses must be designed for LPG service. Hoses must be hydrostatically tested at least once per year. Hoses should be inspected regularly for cuts, cracks, rusted clamps and other signs of damage.

7. The container must not be overpressured. As the liquid LPG flows into a vessel, it compresses and condenses the vapor in the tank to make room for the incoming liquid. This produces heat, which increases the pressure in the receiving container. Overpressure is sometimes controlled by venting the receiving vessel back to the vessel being emptied. If this method is used, the vent line should not be opened until the pressure in the receiving vessel exceeds the pressure in the container being emptied.

8. Before unloading LPG, it must be verified that the tank car or tank truck contains the correct quantity and type of product.

**Loading Railway Tank Cars**

The purpose of Department of Transport regulations governing rail movement of LPG is to protect the public. Penalties for violation of the regulations can be very severe.

It is strongly recommended that persons in charge of loading LPG tank cars work from a check list, and use a form for calculating outage of cars. Department of Transport personnel make frequent inspections of loading facilities and procedures.

The following are many of the items to be checked or done when loading LPG tank cars:

1. A pre-trip inspection of the tank car is required, and any defects should be repaired.

2. The tank car test date and the relief valve test date must be checked to assure these dates fall within required test intervals.

3. The suitability of the car for the product to be loaded must be verified.
4. The hand brake must be set and the wheels chocks applied, to prevent the car from moving.

5. The “stop” sign must be installed at the entrance to the loading siding to prevent railway crews from entering the loading track when cars are being loaded. Derails, if used, must be set.

6. The vapor and liquid lines may be connected and the gauge rod set for 1 m, only after the first five steps are complete.

7. After the loading operation is started, the sample line should be opened momentarily to remove water from the car.

8. The gauge rod should be fitted with the liquid orifice.

9. The temperature of the liquid entering the car must be checked, using the tank car thermowell and an accurate thermometer.

10. The outage required for the particular car must be calculated, using the relative density and temperature of the product being loaded. Then the gauge rod is reset to the calculated height.

11. Odorant should be added if required.

12. When loading is complete, all valves must be closed.

13. After 15 minutes, the gauge rod is raised a few inches and the valve checked for vapor; then the gauge rod is lowered until white mist appears. The gauge is read and the gauging operation is repeated. Then the gauge level, to the nearest 1/4 of an inch, is recorded.

14. The gauge rod and thermometer well are secured.

15. Next, the loading hoses are removed and the connections plugged. An explosive meter is used to check for leaks.

16. The “after unloading” instructions are attached in the dome; then the dome cover is closed and a seal installed.

17. The required placards are placed in the four placard holders.

Note that during the loading process, a responsible person must be in continuous attendance.
Unloading Tank Cars

The following are some of the items to be checked or done when unloading tank cars:

1. Before a tank car is unloaded, it must be protected by flags on the track, have the brakes applied, etc.

2. If the volume of the product in the tank is needed for accounting purposes, the temperature of the contents is checked and the gauge rod raised to full extension and slowly depressed until white mist is expelled. The temperature, gauge rod reading, relative density of the product and the outage tables of the tank car are used to obtain the volume of the contents.

3. “After unloading” instructions contained in the dome must be followed to disconnect lines, plug connections, etc.

4. The placards must be changed to indicate that the car is now empty.

The lessors of tank cars provide information on the suggested procedures for the loading and unloading of tank cars. All persons involved with the loading and unloading of tank cars should become familiar with the information, and should keep it available for quick reference.

Loading Truck Transports

As with rail transportation of LPG, the federal and provincial governments formulate and enforce strict regulations concerning the safe handling of LPG being transported on highways. All persons charged with the duties of loading or unloading LPG should be familiar with the regulations, and realize that stiff penalties may be levied for violating the regulations.

The following is a general procedure to be followed when loading truck transports:

1. No transport should be allowed to approach the loading rack while another transport is loading or unloading.

2. Each transport should be checked by the loading rack personnel for leaks or other obvious defects. All leaks and defects should be reported to the supervisor before the transport is loaded. Loaders should also ensure that the tank is properly equipped and in good order.
3. The transport tanks must be level before loading or unloading to ensure that the relief valve connection is not flooded. See Fig. 4. If the tank were subjected to overpressure with the relief valve flooded, liquid would be vented from the valve and a dangerous hazard created. Accurate gauging of tanks also depends on the tank being level.

![Figure 4](AG6_fig4.gif)

*Figure 4*
*Trucks Must Be Level*

4. LPG transport trucks are subject to maximum filling density regulations. The maximum loading is based on the loading temperature of the product and the relative density of the product. Charts, which are available for all transport tanks, must be consulted to determine the maximum allowable loading.

5. The quantity loaded into the transport is determined from any of the following methods:

   (a) Reading the rotary gauge on the side of the tank.
   (b) Weighing the unit before and after filling.
   (c) Using temperature-corrected meters.

6. Once the truck is in position, all electrical systems must be shut off.

7. Brakes must be applied and the wheels chocked, to prevent the unit from accidentally moving.

8. The vapor and liquid hoses are connected with careful observation for leaks.
9. A qualified person must stand by during the entire loading or unloading operation.

10. Odorant must be applied to the load if required.

11. Proper documentation for the load must be provided and seals installed if required. Required placards must be in place.

12. Assurance that loading hoses are disconnected must be obtained before the truck leaves the rack.

STORAGE of HYDROCARBON FLUIDS

Water in Storage Tanks

The primary function of storage tanks is to hold hydrocarbon fluids before, during, or after various process operations. Most storage tanks have a layer of water below the hydrocarbon fluid. The water level must not be allowed to build up to a level where it can enter the process. Water entering a fractionation tower can cause serious process upsets and possibly damage the internals of the tower. It must be remembered that when water is contacted by hot hydrocarbons, the water will immediately “flash” into steam, with a large increase in volume.

Water can enter a tank through open hatches, gauge board cable openings, leaking steam heater coils, leaking roofs, and many other ways.

Drain lines and valves for drawing water from storage tanks must be protected from freezing. Water freezing in drain lines will cause them to rupture. When the ice melts the product will be lost. Also, oil flowing from such a leak could create a fire hazard. Thus it is important to check for water frequently, and to drain it immediately.

Tank Foamovers

When water vaporizes below the surface of oil having a low specific gravity, a foam usually forms. Under severe foaming conditions, the volume of the foam may be 20-30 times the volume of the oil. The foam may overflow the tank, and perhaps also the firewall surrounding the tank. A serious fire hazard can result.
It should also be recognized that hot heavy oil loaded into a tank or tank truck containing water can result in a foamover. Heavy oil or asphalt that is seasonally stored can collect water. When the oil is eventually heated up, a foamover could result if the heat is not applied very slowly. Periodic checking and good maintenance of tanks and heaters will do much to eliminate this hazard.

**Manual Gauging and Sampling**

Many accidents have happened while workers have been gauging or sampling storage tanks. Since most companies have very strict procedures for tank gaugers to follow, the accidents have usually occurred because procedures were not followed. Some of the hazards involving the gauging of tanks, and some possible causes of injury, are:

1. Toxic vapors existing at the gauging hatch.
2. Faulty or incorrect equipment being used.
3. Required personal protective equipment not being used.
4. Training being inadequate.
5. Correct procedures not being followed.
6. Fire precautions being inadequate.
7. Structures being damaged or unsafe.
8. Gauging or sampling being done during bad weather.

**General Precautions for Tank Gaugers**

The following precautions should be observed:

1. If hydrogen sulphide might be present, two workers should be assigned to the job. One will do the gauging while wearing self-contained breathing apparatus, and the other will observe him from a safe distance so that he can provide rescue aid if necessary. Both workers must be thoroughly trained in the use of, and be equipped with, approved self-contained breathing apparatus, as well as being trained in gas detection procedures.

2. Tanks should not be gauged when thunderstorms are approaching.
3. Any defects in ladders and stairways should be reported, and tools and materials which could be a tripping hazard must not be left on stairways.

4. Smoking is not allowed within a safety zone around storage tanks. “Strike anywhere” matches and single action cigarette lighters should not be carried during the gauging operation.

5. Thief ropes or cords, made of synthetic fibres, may be allowed in some situations. Where there is the possibility of flammable mixtures existing, only lines made of a good electrical conductor should be used.

6. Where there is the possibility of a combustible vapor/air mixture, the gauging or sampling should not be attempted until the static charge on the liquid surface has had time to be reduced. A metal gauging well, which shields the gauge or thief from an electrostatic charge, is supplied in some tanks so that the time interval is not required.

7. Only approved flashlights may be used for gauging operations.

8. A container for carrying gauging equipment should be used so the gauger will have both hands free for climbing vertical ladders. Gauging equipment should be pulled up in a canvas bag or other suitable container using a light weight cord.

Gauging Procedures

The following is a general summary of typical gauging instructions:

1. After climbing to the top of the tank, rest until breathing has returned to normal. Take up a position upwind of the gauge hatch where there will be the least exposure to tank vapors and where there will be no interference while playing out the tape.

2. Allow a sufficient time (up to 30 minutes) for the static charge to be reduced if the tank has just been filled or agitated in any way. A waiting period is not required if the tank is blanketed with an inert gas above the oil, or is equipped with a floating roof, or is equipped with a full depth gauging well. A surface charge, resulting from the loading process, could cause the flammable vapor/air mixture at the surface to ignite.

3. Bond the gauge tape to the tank to equalize the electrical potential between the tank and the tape. Open the hatch about one inch, and allow the pressurized vapor to escape. The gauger should avoid inhaling the vapors.
4. Lower the tape into the tank, sliding it against the side of the hatch while the tape is carefully played out. The tape must be kept in contact with the tank at all times to permit static discharge and to avoid leaving an air gap that could allow sparking.

5. Unroll the tape using the handle on the reel. Avoid dripping liquid when raising a thermometer or tape. Pour the contents of the thermometer cup back into the tank. Wipe up all spills with wipers which should be stored in containers outside the tank area.

Other safety precautions that should be followed are:

1. Be very careful not to drop any containers into the tank because they can become spark promoters on the surface of the liquid.

2. Leave gauge hatches in the closed position unless otherwise instructed.

3. Keep your hands free of oil and keep your gloves clean, because oil can cause dermatitis.

4. Clean off the tape with a wiper, not with your gloves.

**Storage Tanks At Low Temperatures**

Some light hydrocarbons must have a gas blanket above the vapor space to maintain a positive pressure in the storage vessel. For example, below 0°C, the vapor pressure of butane is below atmospheric pressure. To prevent air from being drawn into the storage vessel, a positive pressure is produced by admitting fuel gas or an inert gas such as nitrogen. Air must not be allowed to enter, because an explosive mixture could result.

Some installations divert a portion of the discharge from the unloading pump through a heat exchanger, then warm vapor can be routed back to the vapor space of the container being unloaded. Propane vapor may also be used to pressurize a tank of butane in cold weather, provided the propane that dissolves into the butane does not harm the subsequent use of the butane. Some installations use fuel gas, controlled through a pressure regulator, to provide the pressure required to unload the butane.

A gas blanket also serves to maintain pressure when the liquid is being removed from the tank, thus preventing the occurrence of a partial vacuum, which could damage the tank.
Overfilling Storage Vessels

It must be remembered that when cylindrical horizontal tanks and spheres are being filled or emptied, each metre on the level gauge does not represent the same number of cubic metres stored in the vessel. Special charts are used to determine how much product is in storage and how much can be added. Serious fires have been caused by overfilling storage vessels.

As was the case with mobile storage tanks, a vapor space must be left in case the liquid should expand due to a temperature increase. If the safety valve releases liquid, due to the tank being overfilled, a small quantity of liquid will result in a large cloud of vapor.

Fig. 5 shows how storage tanks are installed with a dike that has the capacity to contain the volume of the storage vessel. Persons entering the area behind the dike must be aware that hydrocarbon vapors, and gases such as hydrogen sulphide, are heavier than air and are invisible; thus they could be present within the confines of a dike. Self-contained breathing apparatus may be required by site specific procedures before entering these areas.

![Figure 5](image)

*Figure 5*

*Storage Tank Dikes*
IMPORTANT HEALTH AND SAFETY INFORMATION
FOR PRODUCERS AND HAULERS OF
“BULK SOUR OILFIELD PRODUCTS”

* Sour Gas (H₂S) from petroleum products and/or by-products being loaded, unloaded or handled during transportation has claimed the lives of at least four Alberta truckers over the past few years.

* None was wearing breathing apparatus.

* Because of these incidents and other “close calls” involving the handling and transportation of bulk products, a committee representing key sectors within the industries was formed to develop guidelines for industry-wide safe operating procedures.

* It is expected that all companies involved in the handling and transportation of bulk sour product will adopt these guidelines for their operating procedures.

* The OHSD acknowledges the assistance of the following groups:
  - Canadian Association of Petroleum Producers
  - Canadian Association of Oil Drilling Contractors
  - Independent Petroleum Association of Canada
  - Alberta Trucking Association
  - and several concerned individuals

These guidelines were developed by industry members for benefit to all groups. Their support is greatly appreciated. For further information and promotional materials (posters, booklets, etc.) on this topic, please contact your local office of Alberta Occupational Health and Safety.
1.0 DEFINITIONS - FOR THE PURPOSES OF THESE GUIDELINES:

1.1 "SOUR PRODUCT" is defined as “liquid petroleum product or by-product, including produced water, which contains or may contain hydrogen sulphide (H\textsubscript{2}S) in sufficient amounts that a worker may be exposed to more than the Occupational Exposure Limit (as prescribed by the Chemical Hazards Regulation) during loading, unloading, gauging or handling the load”.

The Occupational Exposure Limit for hydrogen sulphide (H\textsubscript{2}S) currently is:
- 10 ppm for 8 hours (time weighted average)
- 15 ppm for 15 minutes (time weighted average)
- 20 ppm ceiling limit.

1.2 "BULK” is defined as quantities of 454 litres or greater.

2.0 Where there is the potential for the product being handled or transported to be “sour”

(i) the producer, or his agent, must notify the carrier

AND

(ii) the carrier must notify his workers of the potential hazard of the sour product identified by the producer or his agent.

3.0 A person handling or transporting bulk sour product shall hold a valid certificate from the P.I.T.S. H\textsubscript{2}S “ALIVE” course, or other equivalent course acceptable to a Director of the Occupational Health and Safety Division.

4.0 A person handling or transporting bulk sour product shall ensure that appropriate shipping documentation and placarding is in place as required by law.

5.0 The driver, of a vehicle driven to a site for the transportation of bulk sour product, shall ensure that in the cab there is a checklist which identifies the precautions to be followed to ensure protection from hydrogen sulphide gas (H\textsubscript{2}S).

5.1 The owner of the vehicle or the employer of the driver shall provide the checklist referred to in section 5.0.
6.0 Respiratory protective equipment, as required by Occupational Health and Safety Legislation, shall be available at a work site where sour products are handled and must meet the following criteria:

- Is of a type that will maintain positive pressure in the face piece.
- Has a capacity of at least 30 minutes.
- Provides full face protection.
- In the case of remote supplied air apparatus, is fitted with an auxiliary supply of respirable air of sufficient quantity to enable the worker to escape from the area in an emergency, and
- In the case of self-contained breathing apparatus, is fitted with an alarm warning.

6.1 Where H₂S levels at the work site exceed 20 ppm, workers must wear the above described breathing apparatus.

6.2 Where the producer or his agent intends that the carrier will provide and maintain necessary respiratory protective equipment, the details should be addressed in a contractual agreement.

TRUCKING INDUSTRY CHECKLIST FOR SOUR PRODUCT

The following guidelines have been prepared as a basis on which a company can develop its own specific or more comprehensive checklist of procedures for drivers to follow when transporting or handling bulk sour product.

1. PRE-TRIP CHECKLIST
   - Do you have a valid hydrogen sulphide (H₂S) “ALIVE” Certificate or equivalent?
   - Do you have appropriate placards?

DO YOU KNOW

- The H₂S concentration of the product to be handled?
- Where the breathing apparatus is located?
- The use, fitting and limitation of the breathing apparatus provided?
- If the breathing apparatus is operational?
- If the air supply is adequate?
2. UPON ARRIVAL AT THE SITE
   • Check for wind direction before entering.
   • Check for (and read) all posted signs.
   • Check all breathing apparatus for operation.

3. LOADING - UNLOADING
   • While “in attendance” remain up-wind whenever possible.
   • Wear breathing apparatus when:
     A) Coupling - Uncoupling;
     B) Checking tank levels;
     C) Opening or closing hatches;
     D) H₂S levels exceed 20 ppm.

4. POST-TRIP CHECKLIST
   • Does air supply need replenishing? If so, follow your company’s procedures for refilling.
   • Return and secure all breathing apparatus.
   • Report any unsafe equipment in accordance with your company policy.

NOTE: If any of the required equipment is not present or not operational, or if in doubt in any area of this checklist, ALWAYS FOLLOW YOUR COMPANY’S SOUR PRODUCT AWARENESS GUIDELINES.