Safety Aspects in Transportation & Storage of LPG

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Definitions

Hazard

Situation with a potential for damage to people, machines and environment.

Ex: fire / explosion in LPG storage

: toxicity in chlorine storage

Risk

Combination of hazard consequence and its frequency of occurrence.

Ex: likely death of two persons in 100 years due to loading hose failure.
**Flash Point**

The flash point of a liquid is the lowest temperature at which sufficient vapour given off to flash on the application of flame in the presence of air.

**Auto – Ignition**

The lowest temperature to which a solid, liquid or gas requires to be raised to cause self-sustained combustion without initiation by a spark or flame.
Explosive limits

Explosive limits are those concentrations of a vapor or gas in air below or above which propagation of a flame does not occur on contact with a source of ignition.

**LEL: Lower explosive Limit**

The lower explosive limit is the minimum concentration below which the vapor air mixture is too lean to burn or explode.

**UEL: Upper Explosive Limit**

The upper explosive limit is the maximum concentration above which the vapor air mixture is too rich to burn or explode.
U N Number
The United Nations number is a four figure code used to identify hazardous chemicals and is used for identification of chemicals transported internationally by road, rail and by air.

CAS Number
The Chemical Abstracts Service Registry is a numeric designation assigned by American Chemical Society’s Chemical Abstract Service and uniquely identifies a specific chemical compound. This entry allows one to conclusively identify a material regardless of the name or naming system used.
HAZCHEM Code

- HAZCHEM is a warning plate system used for vehicles transporting hazardous substances, and on storage facilities housing such substances.
- It gives the fire fighting and spillage control procedures to be adopted for each chemical.
- The HAZCHEM Code consists of either two or three characters, the first being a numeral, followed by either one or two letters.
HAZCHEM Code

- The numeral in the range 1 to 4 indicates the type of medium to be employed by the fire services personnel.
  - 1 - indicates the use of solid streams of water
  - 2 - indicates the use of a water fog or fine water spray
  - 3 - indicates the use of a water-based foam
  - 4 - indicates the use of a dry agent such as a dry chemical powder, eg. sodium carbonate or dry sand

- The First Letter (or second character) indicates the type of personal protection to be worn, the possibility of violent reaction, and whether the substances and the medium employed should be contained or the substances diluted. The characters are generally black on a white background.

- The third character, when appearing, is the letter E. This indicates that evacuation of persons in the neighbouring areas must be taken into consideration.

<table>
<thead>
<tr>
<th>Item</th>
<th>Letter</th>
<th>Indicates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal protection</td>
<td>P, R, W, X</td>
<td>Full chemical protection suit and breathing apparatus should be worn.</td>
</tr>
<tr>
<td></td>
<td>S, T, Y, Z</td>
<td>Breathing apparatus need only be worn if the substances are involved in a fire.</td>
</tr>
<tr>
<td>Contain or Dilute</td>
<td>P, R, S, T</td>
<td>Dilution</td>
</tr>
<tr>
<td></td>
<td>W, X, Y, Z</td>
<td>Containment</td>
</tr>
<tr>
<td>Violent Reaction</td>
<td>P, S, S, W, Y, Y</td>
<td>A violent reaction may occur through such occurrences as decomposition, ignition of vapours, acceleration of combustion due to involvement of an oxidising agent or reaction with water.</td>
</tr>
</tbody>
</table>
**HAZCHEM Code**

**HAZCHEM Scale**
FOR FIRE OR SPILLAGE

1  JETS
2  FOG
3  FOAM
4  DRY AGENT

<table>
<thead>
<tr>
<th>P</th>
<th>V</th>
<th>FULL</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>V</td>
<td>BA</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td></td>
<td>BA for FIRE only</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>V</td>
<td>FULL</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>V</td>
<td>BA</td>
<td></td>
</tr>
<tr>
<td>Z</td>
<td></td>
<td>BA for FIRE only</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UN No.</td>
<td>Hazchem</td>
<td></td>
<td></td>
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</table>

**Notes for Guidance**

**FOG**
In the absence of fog equipment a fine spray may be used.

**DRY AGENT**
Water must not be allowed to come into contact with the substance at risk.

**V**
Can be violently or even explosively reactive.

**FULL**
Full body protective clothing with BA.

**BA**
Breathing apparatus plus protective gloves.

**BA for FIRE only**
For fires BA essential. If no fire BA not essential for short exposure.

**DILUTE**
May be washed to drain with large quantities of water.

**CONTAIN**
Prevent, by any means available, spillage from entering drains or water courses.

**CONSIDER EVACUATION**
This is the first priority. In case of doubt evacuate immediate vicinity and request police assistance.
<table>
<thead>
<tr>
<th>Product</th>
<th>UN Number</th>
<th>HAZCHEM Code</th>
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<td>3 Y</td>
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<td>1202</td>
<td>3 Y E</td>
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<tr>
<td>FO</td>
<td>1270</td>
<td>3 Y E</td>
</tr>
<tr>
<td>CRUDE OIL</td>
<td>1267</td>
<td>2 W E</td>
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</tbody>
</table>
Liquefied Petroleum Gas (LPG)

- LP Gas is a general term for a family of liquefied gases, which includes propane and butane and propylene gases in their liquid forms.

- Automotive LP Gas (autogas) is a mixture of propane and butane. It is not the same as the LP Gas used in domestic and portable LP Gas appliances (which is pure propane), and should not be used with these appliances.
Liquefied Petroleum Gas

- Gas is transported under pressure as a liquid in tankers and cylinders.
- Vaporizes rapidly on release and spreads steadily along the ground.
- Is colorless, hence cannot be seen.
- Mercaptan is added to odorize LPG.
- Density of liquid LPG is 0.51 – 0.58 gm/cm³ at 15 °C and is about half the weight of water.
- Is heavier than air and will collect in low lying areas.
- Forms explosive mixture with air.
- Auto Ignition Temperature is around 410 – 580 °C
- Causes dizziness and drowsiness. Vapourising liquid causes frostbite / cold burn.
Any accident while handling LPG during processing, storage or transport is always accompanied by one or combination of the following:

- Fire
- Explosion
- Spillage of LPG from storage or during handling/transportation.
Being essentially a liquefied gas, LPG cannot be stored at atmospheric pressure and temperature.

Two methods of storage can be used:

1. In a pressure vessel at atmospheric temperature but high pressure.
2. In an insulated vessel at low temperature but only slightly above atmospheric pressure often referred to as refrigerated storage. LPG must be chilled to approximately minus 29 deg. C to minus 33 deg. C depending upon the composition to liquefy at atmospheric pressure.
An ignited jet of escaping LPG is called Jet Flame.

Flame direction depends upon the direction of the jet and the wind direction which may bend the flame.

Usually such fires do not cause direct damage beyond the boundary but may lead to domino effect by weakening adjacent equipment which may rupture causing further release of LPG.
Typically this lasts longer than vapour cloud fire.

It creates long, smoky flame, blown several pool diameters downwind.

The wind may bend the flame towards the ground causing few secondary fires.

Such fires are very destructive within plant area and near source of generation but do not cause much damage in a well laid out plant boundary.
Clouds of LPG vapour mixed with air may sustain a propagation flame when ignited.

In certain cases the flame may take place in seconds.

Radiation intensity is severe, similar to a fire ball. This is known as Flash Fire.

Any person caught in flash fire would sustain fatal burn injuries.

The flash fire from a continuous release source would result into fire at source (pool fire or jet fire).
If the flame travels fast, overpressure or blast effects will be created which can cause severe damage at considerable distance from the source of leak.

Vapour cloud ignites and explodes causing high overpressure and consequent damage.

The phenomenon can also be termed as Vapour Cloud Explosion (that can be confined or unconfined).

Escalation due to vapour cloud explosion is very likely as it would result in failure of adjoining facilities.

Tanks and buildings in particular are susceptible to damage from Vapour cloud explosion
Clouds of vapour may burn as a Fire Ball.

This is nearly a spherical cloud of flammable material burning with much turbulence and rising as it mixes with the surrounding air.

The thermal dose and radiation from such a fire ball is very intense and can cause a great deal of damage.

Also known as BLEVE- Boiling Liquid Expanding Vapour Explosion
Boiling Liquid Expanding Vapor Explosion, often referred to by the acronym BLEVE, is a phenomenon which occurs when a vessel containing a pressurized liquid substantially above its boiling point is ruptured, releasing the contents explosively.
What Causes a BLEVE?

Pressure Increases

Closed System

Heat

Temperature Increases

Vapor

Liquid
Heat rapidly decreases pressure. Vapor volumetric expansion can reach 1600 times the original volume. Vessel ruptures as a result of the rapid increase in volume. Vapor and liquid flash vaporizes.

- Pressure rapidly decreases
- Vessel ruptures
- 1600x Vapor volumetric expansion
- Vapor
- Liquid
- Flash vaporizes
- Liquid
Difference between BLEVE and Vapour Cloud Explosion
Kansas City Gasoline Tank explosion (1959)

Feysin (1966)

BLEVEs

Mexico (1984)


Pasadena 1989

Esso Longford 1998


Vapour Cloud Explosions
<table>
<thead>
<tr>
<th><strong>VCE – typical Points</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>➤ Results from ignition of flammable mixture of vapour, gas, aerosol, or mist.</td>
</tr>
<tr>
<td>➤ Sudden or continuous release of large quantity of light hydrocarbons / flammable gases</td>
</tr>
<tr>
<td>➤ Some portion of gas must mix with air.</td>
</tr>
<tr>
<td>➤ Delayed ignition until a cloud of sufficient size has formed</td>
</tr>
<tr>
<td>➤ <strong>Instant and widespread</strong> damage to plant facilities &amp; buildings due to blast pressure.</td>
</tr>
<tr>
<td>➤ Fatalities (mostly instant)</td>
</tr>
<tr>
<td>➤ Injuries (mostly serious)</td>
</tr>
<tr>
<td>➤ VCE followed by fire normally for substantial time</td>
</tr>
</tbody>
</table>
BLEVE – typical Points

- Results from catastrophic failure of a vessel containing a liquid at a temperature significantly above its boiling point at normal atmospheric pressure.

- Rapidly expanding vapour compresses the surrounding air, creating a blast wave.

- Also, as vessel fails, fragmenting may occur.

- Vessel fragments can be propelled a significant distance high initial velocities.

- Commonly associated with releases of pressurized flammable liquids from vessels as a consequence of external fire.

- Can produce thermal radiation effects from a fireball, as well as blast and missile effects (rockets which can travel 2500 ft or more)

- Fragment from one BLEVE can initiate a BLEVE in the nearby second vessel.
Transportation of Petroleum Products

- TANK TRUCKS
- TANK WAGONS
- PIPELINE
- CARGO
Transportation of Petroleum Products – Hazards due to Accidents

- Fire (Flash / Pool / Jet Flame)
- Explosion (VCE / BLEVE)
- Toxic Release
- Loss of containment
- Can cause pollution
- Injury
- Fatality
- Loss of Property
Pipeline Transportation

Advantages of Pipeline Transportation

¬ Loss in transit is less in pipeline transportation as compared to other modes
¬ Pipeline offers large-scale economies of scale in transportation liquid petroleum products
¬ Environmental impact during construction, operation and maintenance is negligible and reversible which is environment friendly
¬ It can be used to transport multiple products
¬ Pipeline transportation is flexible, as the volume transported can be increased/decreased quickly and at negligible cost
¬ Operation/maintenance costs are relatively lower
Road Transportation

- Road transportation is one of the significant mode of dispatch of petroleum products in Marketing Sector.
- This is an area where maximum accidents have occurred.
- According to the data, of the total accidents in Marketing Sector in the period of past 05 years, contribution of road transportation was 70%.
Causes of Accidents

- Poor road condition.
- Bad weather.
- Lack of road discipline – overtaking, over speeding, application of sudden brake.
- Absence of approved parking place.
- Other slow moving transports.
- Human failures due to lack of training.
- Improper fittings on the Tank Truck.
- Mechanical failure due to poor maintenance.
- Driving in alcoholic condition
- Using Mobile phone while driving.
Important Acts and Rules governing Road Safety

- The Motor Vehicles Act of 1988 with latest amendments;
- The Central Motor Vehicle Rules, 1989 with latest amendments;
- The Petroleum Rules, 2002 with latest amendments;
- The Public Liability Insurance Act, 1991 with latest amendments;
- The SMPV Rules of 1981 (UNFIRED) with latest amendments for LPG;
- OISD – RP – 157 - Recommended Practice for Transportation of Bulk Petroleum Products
- OISD – STD – 159 LPG Tank Trucks - Requirements of Safety on Design/Fabrication and Fittings
- OISD –STD – 160 - Protection to fittings mounted on existing LPG tank trucks
- OISD- GDN – 161 - LPG Tank Truck Incidents : Rescue & Relief Operations
- OISD – GDN – 165 - Guidelines for Rescue & Relief Operations for POL Tank Truck Accident
- OISD – RP – 167 - POL Tank lorry Design & Safety
Special Driving Skills

- Defensive / Safe Driving
- Driving at Night
- Driving in the Rain
- Hill Driving
- Fog Driving
- Driving in Water Logged area
- Signaling
- Punctured Tyres
- Brake Failure
- Driving Under Alcoholic Conditions
TREM Card Stands for Truck Rescue Emergency Management Card for Road Transport. It gives information about the nature of hazard the product can cause and protective devices; what emergency action is required to be taken by the driver in the event of spillage / fire, and the First Aid to be given; and a list of Telephone numbers to be contacted in an emergency.

It is compulsory that all drivers carry this card in the T/T and get themselves familiarised with the instructions in the card and act promptly whenever the emergency arises.
TRANSPORT EMERGENCY CARD (ROAD)

Cargo : Liquefied Petroleum Gas

Nature of Hazard : Liquid under pressure and highly inflammable
Vapors – colorless, heavier than air and creep along the ground.
Heating of container will cause pressure rise
and severe risk of explosion.
Gas causes nausea, breathlessness, and headache.
Contact with liquid can cause cold burns. Spilled liquid evaporates very rapidly
Air – Vapor mixture is highly explosive

Protective Devices : PVC / Synthetic gloves, Safety goggles, Self contained respiratory device.

EMERGENCY

If possible, try to move out the vehicle to an open area. Stop the engine. The vehicle should not be left unguarded.
Contact Police, Fire Brigade, Sarpanch, nearest Oil Company.
Keep public and traffic away from by displaying ‘Danger’ board at about 50 m. away.
No smoking and no naked lights in the cordoned off area. Stay upwind.

Spillage
Check the valve for tightness by hand and stop leak, if possible.

Fire
If minor, try to extinguish by DCP fire extinguisher.
If eyes are affected, wash out with plenty of water. Remove contaminated clothing; wash affected parts with plenty of water. Seek medical help.

Emergency Telephone Numbers

IOC/ HPC/ BPC/IBP
Fire Brigade : 101
Police : 100
सावधान !!!

1. चारख पीकर गाढ़ी न चलाएं।
2. कूपा एन. पी. जी. वाहन के पास पुराना न करें।
3. एन.पी.जी. वाहन को शेयर साहब पर खाड़ा करते समय पालक माइक न कोई आस रखें।
4. किसी भी प्रकार की आग के पास वाहन को खाड़ा न करें।
5. सड़क क्षेत्र पर कभी भी एन.पी.जी. वाहन को अकेला न छोड़ें।
6. एन.पी.जी. वाहन को हंगामा फ्रीड-आउट के क्षेत्र से दूर रखें।
7. एन.पी.जी. वाहन के नीचे खाड़ा न करें।
8. एन.पी.जी. वाहन के नीचे खाड़ा न करें।
9. रिसाइकल करने पर या आग लगने पर नजरबंदी पुलिस स्टेशन एवं कारर विभाग को सूचित करें।
10. यदि खाड़ी लग रही हो या सिस्टम में हो तो गाढ़ी को लाज के किनारे बुझाया स्थान पर खाड़ा करके आराम करें।

इंडेन बाटलिंग प्लांट
इंडियन ऑयल कॉर्पोरेशन लिटी
हरहुआ, वाराणसी (30 पूरी)

Truck Rescue Emergency Management Card
(Road)

परिवहन अपाल कार्यालय इंडियन ऑयल कॉर्पोरेशन लिटी
हरहुआ, वाराणसी (30 पूरी)

U.N. NO. 1075 Hazchem Code 2WE

R
c

दबित पेट्रोलियम गैसेज
(एन.पी.जी.)
Liquified Petroleum Gases
(L.P.G.)

Indian Oil Corporation Ltd.
Indane Bottling Plant
Harahua, Varanasi
Phone: 0542-2622309, 2622310
Fax: 0542-2622311
छोटी आग लगने पर -
1. रिसाव को बदल करें, आग को पानी से ढाल करें।
2. यदि रिसाव तुरंत बदल नहीं कर सकते हैं तो आग को जलाएं।
3. द्वार के बाहर फायर हैटर व कार्बोनाईड आवास पारित कार अपनाएं।
4. रेत और पानी की पानी से ढाल करें।
5. यदि आग वाले हैं तो वाले के अंद-बाहर के क्षेत्र पानी की पुंखाली से ढाल करें।
6. आग पाने के लोगों को सुनिश्चित करें।
बड़ी आग लगने पर -
1. आग वाले कोड 1 सिक्का, क्षेत्र प्रांगण करें।
2. टैंक को पानी की पुंखाली से ढाल करें।
3. नाशिक को टैंक के साथ पानी पहुंचाएं।
4. यदि आग वाले हैं तो सीधा जोड़ पर करें अर्थात् मर्मांकन।
5. यदि आग वाले में मानव पर धोखा दें और फायर हैटर व कार्बोनाईड आवास निर्माण का प्रयोग करें।
6. यदि फायर हैटर से रेत का प्रभाव नहीं है तो तुरंत उस लोगों को जलाएं।
7. नजदीकी फायर हैटर व कार्बोनाईड आवास का प्रयोग करें।
8. यदि आग को बदल कर नहीं सकते हैं तो ही हैं, फायर हैटर व कार्बोनाईड आवास का प्रयोग करें।
9. यदि आग को बदल नहीं सकते हैं तो तुरंत उस लोगों को जलाएं।

प्रामाण्य उपकरण -
1. रेतों का प्रभाव नहीं है तो तुरंत उस लोगों को जलाएं।
2. यदि आग वाले हैं तो कम 15 मिनट बाल पानी से बनाएं और फायर हैटर का प्रयोग करें।
3. यदि आग वाले में बदल कर नहीं सकते हैं तो यह लोग आग से बचाव करें।

आपात कालीन रिश्तेदार में सम्मेलन करें -

इंडियन ऑयल क्यूटन प्लांट
हरदूमा, भारत (30 मई)
फोन : 0542-2622309, 2622310
फेक्स : 0542-2622311
A TT must have a Class Label and Emergency Information Panel (EIP) painted as per MV Act. Where as EIP must be painted as per specifications on the rear and both side of the TT, class label must be painted on the cabin top and front cover of the engine. EIP and class label should be clearly visible from outside.
Emergency Information Panel

- Correct Technical Name
- UN No. 15
- HAZCHEM 15
- In case of Emergency Dial 30
- Specialist Advice 15

Note 1 - Class labels
Note 2 - Subsidiary Risk Label

Front

Side

Back
<table>
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All wiring of vehicle should be checked regularly.

A thorough check should be made of any wiring which has been in contact with the load (due to possibility of insulation failure).

The fire extinguisher should be regularly checked and serviced and should not be chain locked.

The tanker should carry portable road barriers.

The driver should walk round the vehicle at least 2 hours to check the pressure and temperatures of the product, to see that no leaks have developed and to check temperature of the hubs and tyres or to spot any other abnormality in the vehicle.
The drivers should be told to stop the vehicle and telephone for advice if there is the slightest sign of overheating.

The drivers should make sure that a competent person is doing the unloading operation at the receiving end.

While delivery is taking place, the driver or the attendant must keep a constant watch on the vehicle.

The engine must be stopped before commencement of loading.

The tank-truck should be properly earthed before commencing discharge (unloading).

The driver must not allow anybody other than a responsible man nominated by the company to drive the vehicle. Drivers should have valid driving license.
Anyone engaged in loading, unloading and conveyance of dangerous liquid and gases must take all the precautions for preventing fire or explosion and must ensure as far as reasonably possible all liquid escapes into any sewer or drain.

Any one attending the vehicle which is carrying flammable or combustible products is forbidden:

- To smoke
- To carry matches
- To carry artificial lights capable of ignition
- To carry anything capable of causing fire and explosion

The driver should make sure that all the labels written on the tanker are clean and legible.

The driver should carry the transport emergency card (TREM Card); of the product which is loaded in the tanker/truck.
Do’s and Don’ts to avoid hazards during transportation by road

- The driver, before starting the loading or unloading should put the wheel arresting blocks (wheel chocks) on all the wheels.
- The vehicle should be equipped with a First-Aid Box and personal protective equipment as prescribed in “TREM Card”.
- Vehicles should always be parked in safe place and guarded by the driver or the cleaner so that nobody tampers with vehicle or the product.
- In case of an accident, the vehicle should, as far as practicable, be moved to a safe location to prevent other vehicles from colliding with it.
- Member of the public should be kept away from the accident site and in case of leakages, sources of ignition should be extinguished and if necessary, public should be evacuated to safer place.
Tank Trucks Safety Fittings
1. SAFETY RELIEF VALVES FOR VESSEL.
2. ULLAGE GAUGE.
3. ROTOGAUGE.
4. MANHOLE.
5. PRESSURE GAUGE WITH EXCESS FLOW VALVE.
6. LIQUID INLET/OUTLET BYPASS LINE VALVES WITH EXCESS FLOW CHECK VALVES.
7. VAPOUR RETURN LINE VALVE WITH EXCESS FLOW CHECK VALVE.
8. MARKING PLATE.
9. MASTER CUT-OFF SWITCH.
10. FIRE EXTINGUISHER (DRY POWER CHEMICAL)
11. FIRE EXTINGUISHER (DRY POWDER)
12. FUEL TANK WITH STEEL GUARD.
13. FLAME TRAP.
14. WIRING FOR TAIL LIGHT IN CONDUIT PIPE.
15. WELL FOR THERMOMETER.

DESIGN PRESSURE = 5.96 kg/cm².
HYDRAULIC TEST PRESSURE = 20.94 kg/cm².
DESIGN TEMPERATURE = 55°C
RADIOGRAPHY 100% STRESS RELIEVING REQUIRED.
EMPTY WEIGHT = 3814 kg.
WATER CAPACITY = 12662 Lts.
DESIGN CODE ASME SECT. VIII Div.1 LATEST EDITION.
Safety Fittings on a LPG Bullet

- Safety Relief Valve – ensures the release of pressure in excess of set pressure.
- Excess Flow Check Valve - valve shuts off if the flow exceeds the set limit
- Roto-Gauge - measures the volume of LPG in a bullet in terms of percentage.
- Master Cut-Off Switch - isolates the battery connection from all electrical components of the Bullet.
- Fire Extinguishers
- Spark Arrestor
- Electrical Wiring / Electrical System
Transportation By Rail

The Railways Red Tariff Rules, 1960 under Indian Railways Act 9 of 1890 lays down the procedure and stipulates conditions for the carriage by rail of dangerous goods except explosives for Defence Services.
Transportation By Rail

Salient features of the regulations are:

- Dangerous goods are classified into seven categories, i.e.
  - Explosives
  - Gases – compressed, liquefied or dissolved under pressure
  - Petroleum and other inflammable Liquids,
  - Inflammable solids
  - Oxidising Substances
  - Acids and Other Corrosives
  - Poisonous (Toxic) Substances.
- Separate dealing for each group.
- No hazardous goods other than listed will be accepted.
- Loading / unloading of these goods will be done by Consignee.
- Quantity to be loaded in accordance with prescribed norms only.
- Precautions, as given in the regulations to be observed during handling and storage.
- For petroleum products, advance confirmation of readiness to accept goods on arrival is necessary.
- Dangerous goods to be removed fast from the premises.
Tank Wagon Safety Fittings
Tank wagons for LPG (Railway Code TG) (4 wheeler/8 Wheeler)

- Provided with safety valve with Discharge Capacity of 10.3 cum/sec.
- All other fittings such as liquid valves, vapour valves, magnetic gauging device, thermo-well, sampling valve and safety valves, pressure gauges are provided on the top of the pressure vessel in a protective housing known as ‘dome’ with a cover.
- For repairs & maintenance, tank wagons are to be degassed by filling water.
- While commissioning tank wagons are required to be purged with LPG/inert gases.
THANK YOU
Safety Checks at ALDS
Safety Checks at ALDS

- TT to be unloaded during non peak hours at location approved by CCOE.
- Unloading to be done in presence of authorized person & TT crew.
- 2 no. 10 Kg FE to be kept in readiness.
- TT to be placed in drive out position.
- Master cut off switch of TT to be kept in off position.
- Wooden Stoppers (Chokers) to be placed under wheels.
- TT to be bonded.
- LPG level in the storage tank to be monitored regularly.
During TT decantation process

- Ensure bobtail entering the ALDS for decantation is fitted with Spark Arrestor.
- Ensure Bobtail is parked / Positioned on the demarcated area only.
- Bobtail should be earthed to the additional earthing point provided near fill point.
- Ensure all body valves on the Bobtail and Fill Point are closed.
- Connect the Liquid & vapour Quick Release Couplings on the Fill Point first and then on the Bobtail.
- Open the Remote Operated Inlet Valves mounted on the tank.
- Ensure that the flow meter on the bobtail is re-set to Zero.
- Engage the PTO on the Bobtail for operation of Hydraulic Pump.
Earthing

- Check the earthing connections and condition of earthing of panel/ pump motor skid etc.
- Check the jumper of LPG pipe line.
- Pour the water into earthing pit every month
- Check the condition of grounding electrode

**Maintenance Agency:** Manufacturer of Equipment / owner
Safety Checks at ALDS

Panel
- Check the condition of panel
- Check the condition of indicator
- Check the flame proof fitting & junction box
- Check the condition of cable duct & wiring
- Check the voltage of Panel RYB

Agency: RO Pump operator
Safety Checks at ALDS

Storage area

- Check any visible sign of leakage with explosive meter
- Check for vegetation (dry grass leaves) to be removed
- Check the house keeping
- Clean and check the condition of all valves, metering equipments, temperature & pressure gauge and other equipments installed within yard and on the Dispenser
- Check the temperature and pressure daily before starting the sale
- Check the compressor FRL unit daily
- Check the compressor pressure
- Drain the water air receiver every after 15 days.

Agency: RO Pump operator
Dispensing

- Check the EPB working and ROV operation every day
- Check the condition of nozzle, jaws swivel joints
- Check the condition of dispensing hose pipe before first filling.
- Check for cuts, warn spots or kinked area on the hose pipe daily
- Check the condition and portion of fire extinguisher
- Check the availability of the first aid box
- Check the dispensing pressure of dispenser and submersible pump.
- Check the excessive noise and abnormal vibration of submersible pump, if any, during dispensing.

Agency: RO Pump operator
Decanting

- Check the EPB/ESD & ROV's functioning
- Check the fill point to tank line
- Check the level of storage tank and tanker
- Check the temperature of storage tank and tanker
- Dispensing should be stopped during unloading
- Other fuel should not be decanted while unloading of LPG is on
- Decanting hose pipe to be kept into PVC pipe with end caps.

Agency: RO Pump operator
At the end of day

- Check and note down level gauges.
- Check and note down the dispenser mechanical totaliser reading.
- Dispenser hose should be positioned properly and filling gun should be kept into holder.
- Shut off the compressor valve
- Switch of the panel and switch of the main supply

Agency: RO Pump operator
Emergency Handling Procedures at ALDS
Spill or Leak

- Shut off engine and any electrical equipment and leave ‘off’ until vapour hazard is removed.
- If available, use outside ‘Emergency Stop’ handles.
- No smoking or naked lights within 70 m.
- Move people from the area, move upwind.
- Avoid breathing vapour and contact with liquid or gas.
- Spray water to disperse gas cloud but avoid spraying water directly on leaking containers as this will increase leakage.
- Prevent spillage from spreading or entering underground drains by banking with sand or earth.
- Don’t start the vehicle engine or other engines and don’t operate electrical equipment in the area.
- Inform the fire brigade and police.
Emergency Handling Procedures at ALDS

Fire

- Shut off engine and any electrical equipment and leave ‘off’ until vapour hazard is removed.
- Move people from the area, move upwind.
- Send messenger to inform the fire brigade and police. Tell them location, material and quantity.
- Attempt to cut off source or gas rather than put out fire.
- Remove containers from vehicle if not in area of fire, or remove other material to prevent spread of fire to containers.
- If fire gets out of control, evacuate area and warn against entry.
Tanker / Vehicle Accident

- Shut off engine and any electrical equipment and leave ‘off’ until vapour hazard is removed.
- Move people from the area, move upwind.
- Check for spills of leaks.
- Send messenger to inform the fire brigade and police. Tell them location, material and owner. Indicate condition of vehicle and any damage observed.
- Don’t start the vehicle engine or other engines and don’t operate electrical equipment in the area.
- If tanker is on fire, evacuate area and warn against entry.
Major LPG Transportation Accidents
Road Accident At Kannur

- LPG Bullet Truck hit a road divider on 27th Aug and toppled.

- Leakage of LPG started and subsequent fire from an unknown ignition source and BLEVE took place.

- Around 20 nearby houses / shops were damaged.

- 20 fatalities, 20 injuries
Road Accident At Kannur
Road Accident At Kannur
Road Accident At Kannur
Road Accident At Kannur
Loaded LPG TT met with an accident and caught fire near Baghpat, UP.

When the driver was taking a turn, TT hit a nearby 11 KVA pole and energized line fell on the TT causing fire.

Cause: TT Driver was in drunken condition.

Total product was lost and the TT also got burnt completely.

There was no casualty. However around 10-12 buffaloes and 5-6 houses have got burnt.

TT driver is hospitalized & cleaner not traceable.
LPG TT BLEVE and Fire at Baghpat, UP on 18.09.14
Explosion of Tanker in Uganda – Jun 29, 2013
A car crashed into a moving gas tanker, sparking a fire that killed at least 33 people and left another 29 people badly burned in Uganda on June 29, 2013.

The gas tanker exploded after colliding with a passenger car causing a leak on the outskirts of the Ugandan capital, Kampala.

Most of the dead were passenger motorcyclists who had tried to siphon gas from the tanker after the driver abandoned it.

Moments later the tanker burst into flames, engulfing nearby cars and scores of people.

Investigators concluded that the crash was an accident.
Explosion of Tanker in Uganda
Explosion of Tanker in Uganda
Explosion of Tanker in Uganda
Oil Tanker Fire in Gainford – Oct 19, 2013
13 cars, four carrying petroleum crude oil and nine loaded with LPG of Canadian National Tanker Train derailed at around 1am local time in the hamlet of Gainford, about 50 miles from Edmonton on Oct 19, 2013.

Three cars began leaking and caught fire.

Residents of Parkland County reported seeing a fireball shoot across the sky after one of the cars carrying liquefied petroleum gas exploded.

No one was injured and nearby areas were immediately evacuated.
Oil Tanker Fire in Gainford
Oil Tanker Fire in Gainford
Oil Tanker Fire in Gainford
Oil Tanker Fire in Gainford
Oil Tanker Fire in Gainford
Thanks
Cloudburst in Mandi distt, Himachal, 2015.
Earthquake in Mandi distt, Himachal, 2015.
Flood in Kinnaur District, Himachal, 2013. (>5500 deaths)
Uttarakhand flood in 2013.
Uttarakhand flood in 2013.
Uttarakhand flood in 2013.
Uttarakhand flood in 2013.

People look at a collapsed road and the flooded river in Uttarakhand.
Kashmir flood in 2015
Landslide caused by a magnitude-7.0 earthquake in Iwaki, Fukushima 2011
Landslide caused by a magnitude-6.8 earthquake in Taiwan, 2010
Landslide in Darjeeling
Nepal Earthquake, Laprak Village
Auto ignition, flash point and explosive limits of some of the petroleum products

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>MATERIAL</th>
<th>AUTO IGNITION TEMPERATURE °C</th>
<th>FLASH POINT °C</th>
<th>EXPOSING RANGE VOLUME % IN AIR LOWER LIMIT</th>
<th>UPPER LIMIT</th>
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<td>1</td>
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<td>DEPENDS UPON THE NATURE OF CRUDE</td>
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<td>SKO</td>
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<td>35</td>
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Auto ignition, flash point and explosive limits of some of the petroleum products

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<th>FLASH POINT ºC</th>
<th>EXPOSING RANGE VOLUME % IN AIR LOWER LIMIT UPPER LIMIT</th>
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<tbody>
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<td>65.6-148.9</td>
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<td>FO</td>
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<td>LPG</td>
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<td>GAS</td>
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</tbody>
</table>
External fire plays directly on liquefied gas vessel.

Liquid boils enabling a part of the vessel to heat up and rupture.

Liquid escapes from vessel, boiling, creating a expanding vapour cloud with huge amounts of energy.
The immediate cause of the BLEVE is rupture of the container. If the pressure inside the vessel exceeds the outside strength of the walls the vessel will fail.
If the vessel is overfilled and expansion (due to boiling of liquid) results in a heavy hydrostatic pressure.
If the vessel is weakened by mechanical damage or by high temperature resulting from immersion in a fire then failure can occur.
When BLEVE is initiated, the liquid boils off rapidly producing a reaction which turns parts of the ruptured vessel into rockets which can travel 2500 ft or more.

The liquid can take fire if it is flammable and burning material can spread over a large area. If the gas or liquid mixes with air a vapour cloud explosion can occur.

Fragment from one BLEVE can initiate a BLEVE in the nearby second vessel.
60% of the expanding energy of LPG is converted to kinetic energy. Maximum initial velocity is observed:

- Horton Sphere : 200 m/sec
- Bullet : 150 m/sec

In case of LPG, distance reached by fragments are as under:

- Horton Sphere : 600 M
- Bullet : 1200 M
General Instructions For Drivers

- Keep the vehicle fit in all respect.
- Maintain speed as per prescribed limits.
- Do not drive under mental stress conditions.
- Park your vehicle in safe place. Do not park near naked flames.
- Do not carry flammable material in cabin. Do not light agarbatti / stove in and around truck.
- Use prescribed route only.
- Be more careful during early morning and evening timings.
- Drive carefully on wet, slippery roads and slopes.
General Instructions For Drivers

- Be careful while crossing railway crossing.
- If vehicle breaks down on road, park it on a safe location and use lights or other visible signals to mark the vehicle.
- Do not drive under the influence of liquor.
- Be careful of animals and small children on the road. Their behavior could be unpredictable.
- Use dip lights during night. Keep side blinkers, brakes lights always in working conditions and use them for the benefits of fellow drivers.
- No TT will be allowed to enter inside a Bottling Plant / Petroleum Installation without a helper.
- Do not use Mobile phone while driving.