

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, OCTOBER 2, 2000, (<http://www.chemsafety.gov>).

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Location : Manchester, USA

Injured : 0 **Dead :** 1

Abstract

An explosion occurred at a manufacturing plant killing a worker. The worker was working alone on a machine grinding magnesium when the explosion occurred.

An investigation into the cause of the incident is being carried out.

[fatality, grinder]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, OCTOBER 12, 2000, (<http://www.chemsafety.gov>), Disclaimer: The Chemical Incident Reports Center (CIRC) is an information service provided by the U.S. Chemical Safety and Hazard Investigation Board (CSB). Users of this service should note that the contents of the CIRC are not intended to be a comprehensive listing of all incidents that have occurred; many incidents go unreported or are not entered into the database. Therefore, it is not appropriate to use the CIRC database to perform statistical analysis that extends conclusions beyond the content of the CIRC. Also, although the CSB never knowingly posts inaccurate information, the CSB is unable to independently verify all information that it receives from its various sources, much of which is based on initial reports. CIRC users should also note that the CSB receives more comprehensive reports about incidents that occur in the U.S.; comparisons made between U.S. incidents and those in other nations should take this fact into consideration.

Location : Bamble, NORWAY

Injured : 0 **Dead :** 0

Abstract

A fire occurred in a pile of magnesium at an industrial site. Residents in a one kilometre radius were warned to stay in doors and nearby roads were closed as a precaution due to the danger of an explosion and fallout of hot magnesium.

Fire fighters struggled to control the fire as magnesium reacts with water. Fire fighters attempts to contain the fire with salt failed, as the salt melted in the extreme heat.

[fire - consequence]

Lessons

13153October 2000

Source : THE ENGINEER, 20 OCTOBER 2000, P7.

Location : , UK

Injured : 0 Dead : 0

Abstract

Radioactive iodine was released from a nuclear power station. It was reported that the release was apparently within the authorised discharge level. An investigation into the incident is underway. Checks on milk and grass in the area are being carried out.

A split fuel can in the plant's pressurised water reactor is thought to have caused the iodine to leak into the coolant circuit. The iodine was then drawn off as a gas and vented through the authorised route.

[gas / vapour release, reactors and reaction equipment]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, SEPTEMBER 11, 2000, (<http://www.chemsafety.gov>).

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Location : Rogers City, USA

Injured : 0 **Dead :** 0

Abstract

A fire occurred at a warehouse containing unknown amounts of fertilisers, herbicides, insecticides and pesticides. The fire totally destroyed the building. The cause of the fire is not known.

A half-mile area surrounding the fire was evacuated as a precaution.

[fire - consequence, warehousing, evacuation, unidentified cause]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, NOVEMBER 2000.

Location : Kenya, AFRICA

Injured : - **Dead** : 25

Abstract

A rail transportation incident. Six cars of an eight-car freight train containing liquefied petroleum gas (LPG) exploded when the train overturned. Twenty-five people were killed and several injured in the incident.

[explosion, fatality, injury]

Lessons

[None Reported]

Source : BBC NEWS, 20 AUGUST, 2000, (<http://www.bbc.co.uk>).

Location : Athi River, AFRICA

Injured : - **Dead** : 17

Abstract

A rail transportation incident. A train carrying liquefied petroleum gas (LPG) exploded killing seventeen people and injuring many others.

The incident occurred when the train carrying eight coaches of gas overturned.

[explosion, fatality, injury]

Lessons

[None Reported]

1252025 May 2000

Source : BBC NEWS, 26 MAY, 2000, (<http://www.bbc.co.uk>); CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, MAY 26, 2000, (<http://www.chemsafety.gov>).

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Location : Hampshire, UK

Injured : 10 **Dead** : 0

Abstract

A chemical fire occurred at a jacuzzi and spa manufacturers injuring ten people. The chemicals involved in the fire were liquid petroleum gas and fibrous resin. Hundreds of nearby workers and residents were evacuated as a precaution.

Symptoms from smoke inhalation can include irritation and a burning sensation to the eyes, mouth and throat, chest tightness, short of breath, headaches and stomach upsets. The symptoms can take up to eight hours to emerge.

[fire - consequence, evacuation, LPG, injury]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 8 MAY, 2000, (<http://www.chemsafety.gov>)

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Location : Perry, Florida, USA

Injured : 1 **Dead :** 1

Abstract

An explosion occurred at a munitions plant. The building destroyed in the explosion, contained magnesium, a highly flammable metal used in flares.

One worker was killed and another was injured in the explosion.

An investigation into the cause of the explosion is underway.

[fire - consequence, fatality, storage, injury]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, JULY 2000,; LLOYDS LIST.

Location : Gateshead, UK

Injured : 2 Dead : 1

Abstract

An explosion occurred at an LPG plant in a gas bottle storage area killing one and injuring two others.

The incident occurred during unloading of a road tanker.

[fatality, injury]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 7 APRIL, 2000, (<http://www.chemsafety.gov>),

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Location : Anchorage, USA

Injured : 0 **Dead :** 0

Abstract

A fire occurred on a tank at a tank farm. The tank contained 2,000 gallons of jet fuel, which caught fire during cleaning operations. Chemical foam was used to extinguish the fire.

No one was injured in the incident.

[fire - consequence]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 28 MARCH, 2000, (<http://www.chemsafety.gov>)

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Location : Orangeburg, USA

Injured : 0 **Dead :** 0

Abstract

A rail transportation incident. A rail tanker containing isobutylene derailed and overturned forcing the evacuation of the surrounding area. The incident occurred when the rail tanker was being moved to a siding rail to allow another train to pass on the main line, when one of the wheels fell off. Isobutylene is a colourless liquid used in the manufacture of synthetic rubber and resins.
[derailment - consequence, wheel broken]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 21 MARCH, 2000, (<http://www.chemsafety.gov>).

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Location : Hollywood, Florida, USA

Injured : 0 **Dead :** 0

Abstract

A rail transportation incident. Nearby businesses and roads were evacuated when four cars of a train derailed and overturned.

One car containing hydrogen peroxide poured thousands of gallons onto the surrounding area, another poured limestone and a petroleum compound spilled from a third car.

Cleanup operations are underway.

[evacuation, derailment]

Lessons

[None Reported]

1226010 March 2000

Source : CNN.COM, U.S. NEWS, 10 MARCH, 2000, (<http://www.cnn.com>).

Location : Baia Mare, ROMANIA

Injured : 0 Dead : 0

Abstract

Approximately 20 tonnes of tailings and residues of heavy metals zinc, lead, iron spilled into a river after a dam broke at a lead and zinc mine.

The incident occurred after heavy rain.

A team of experts is carrying out an investigation into the incident.

[environmental, ecological damage, material of construction failure, weather effects]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, FEBRUARY 4, 2000. (<http://www.chemsafety.gov>).

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Location : , USA

Injured : 0 **Dead :** 0

Abstract

A road transportation incident. A road tanker carrying a mixture of lead and chromium started to leak, forcing the evacuation of nearby residents and road closures.

The roads were closed four a couple of hours as a precaution as the chemicals are dangerous if inhaled.

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, JANUARY 13, 2000, (<http://www.chemsafety.gov>).

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Location : , USA**Injured :** 7 **Dead :** 0**Abstract**

An explosion and fire occurred at a metal recycling company, four workers were critically burned and three others were injured.

The incident occurred on a newly installed machine used to strip copper off the tops of military shell casings. A spark from the machine is thought to have somehow caused the explosion.

It is possible some residual powder in the shells, such as magnesium, may have detonated if it came in contact with sparks from the machine.

A full investigation is being carried out into the cause of the explosion.

[fire - consequence, burns, injury]

Lessons

[None Reported]

132232000

Source : EUROPEAN CHEMICAL NEWS, 18 DECEMBER 2000 - 7 JANUARY 2001.

Location : Ludwigshafen, GERMANY

Injured : 0 **Dead** : 0

Abstract

A chemical spill occurred at a chemical plant. The incident occurred when a drum of isopropanol and methyl vinyl ketone burst injuring a worker and affecting several others including visitors at the site.

It is thought that a drum containing residue of caustic soda was accidentally filled with the mixture causing the drum to rupture.

[accidental mixing, drums]

Lessons

[None Reported]

1222717 November 1999

Source : CHEMICAL HAZARDS IN INDUSRTY, FEBRUARY 2000.; CHEM. WEEK, 1 DECEMBER 1999, 161(45), 18.

Location : Texas, USA

Injured : 2 Dead : 0

Abstract

An explosion occurred on a liquid propane gas line. Two people were injured.

The most likely cause of the explosion is thought to have been due to two passing trucks igniting a vapour cloud, which had formed from a leak in the pipeline.

[road transport, road transportation, LPG, hot surface, leak, vapour cloud explosion, injury]

Lessons

[None Reported]

Source : BBC NEWS, NOVEMBER 8, 1999, (<http://www.bbc.co.uk>).

Location : , UK

Injured : 0 Dead : 0

Abstract

A marine transportation incident. A cargo ship carrying bananas and pineapples collided with a tower causing a 26m gash in its side and five tonnes of lubricating oil to spill into the sea. The vessel also held approximately 440 tonnes of heavy fuel oil and 70 tonnes of diesel. It was not thought that the ship was in danger of sinking.

[container ship, collision]

Lessons

[None Reported]

Abstract

A rail transportation incident. A chemical tanker of a freight train derailed spilling flammable liquid for about eight hours before clean-up crews contained the leak. All but six cars that jumped the tracks were empty. The cars that derailed contained talc, liquefied petroleum gas, petroleum distillates and plastic pellets.

The leaking car carried approximately 18,000 gallons of petroleum distillates, it was not immediately known how much had been spilled.

A small grass fire started after the derailment but was quickly extinguished.

The cause of the derailment was being investigated.

[derailment - consequence, fire - consequence, spill, kerosene]

Lessons

Distillates are petroleum liquids, such as kerosene, that are produced during the oil distillation process.

Source : HAZARDOUS CARGO BULLETIN, SEPTEMBER 1999.

Location : Massachusetts, USA

Injured : 0 **Dead** : 0

Abstract

A rail transportation incident. Thousands of gallons of latex spilled into a river when several cars of a train derailed. The cause of the incident is thought to have been due to hot weather buckling the rails.

[derailment - consequence]

Lessons

[None Reported]

1199414 May 1999

Source : CHEMICAL HAZARDS IN INDUSTRY, JULY 1999.

Location : , SOUTH KOREA

Injured : 3 **Dead :** 0

Abstract

A fire occurred on a unit making kerosene and gas oil at a refinery. The hydrocracker where the fire occurred used fuel oil to make middle distillates and had a desulphuriser which made low sulphur fuel oil. The fire was brought under control within two hours.

At least three people were injured.

At the time of the incident the refinery was operating normally.

[fire - consequence, processing, injury]

Lessons

[None Reported]

11246May 1999

Source : BBC NEWS, 16 MAY, 1999, (<http://www.bbc.co.uk>); CNN.COM, U.S. NEWS, 15 MAY, 1999, (<http://www.cnn.com>).

Location : , AFRICA

Injured : 0 Dead : 0

Abstract

A team of specialist fire-fighters were sent to tackle a huge oil tank fire that had been burning for two days which threatened strategic oil stocks near a refinery.

The refinery next to the burning tank was not seriously threatened, however, one of the 13 tanks in the storage complex contained highly inflammable jet fuel which could have triggered a wider inferno, if the fire had reached it. The fire was eventually extinguished after a two day effort by fire-fighters.

The fire destroyed approximately 30,000 cubic metres of petroleum products.

It is not immediately clear what started the blaze, but witnesses said they heard an explosion before the tank, containing super grade gasoline, caught fire.

[storage tanks, fire - consequence, damage to equipment]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, SEPTEMBER 1999.

Location : , NETHERLANDS

Injured : 0 **Dead :** 0

Abstract

A marine transportation incident. A lighter carrying 2,050 tonnes of kerosene ran aground. The vessel was refloated and was found to be leaking from its cargo tanks.

[spill, ship ran aground]

Lessons

[None Reported]

1291925 March 1999

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

During blind replacement a flange was cracked open releasing LPG, the contractors attempted to close it but this was not possible due to icing.

A steam lance was used to warm up the flange so that it could be closed but this was unsuccessful.

The emergency services were called to assist in the dispersion of the gas cloud.

Measures were taken to remove the source of the LPG including checking of all isolation valves. Finally the pump was started to transfer the butane to the gasoline bleeding system. The leak stopped.

[gas / vapour release, operation inadequate, maintenance]

Lessons

[None Reported]

122291999

Source : CHEMICAL HAZARDS IN INDUSRTY, JANUARY 2000,; J. OCCUP. HEALTH SAFT. AUG. N. Z., OCT 1999, 15(5), 406.

Location : , AUSTRALIA

Injured : 0 **Dead** : 0

Abstract

Approximately 10,000 litres of LPG escaped to atmosphere when the driver of a road tanker drove off without disconnecting the filling hose. Fortunately the gas did not ignite. Nearby residents were evacuated as a precaution.

After an investigation the company was fined A\$2500 (1999), for the storage tank not meeting the Australian Standard AS 1596-1989.

[gas / vapour release, human causes, evacuation, loading, storage tanks]

Lessons

[None Reported]

Source : ICHEME

Location : , MALAYSIA

Injured : 12 Dead : 0

Abstract

An explosion occurred on an air separation unit on a middle distillate synthesis plant.

The plant is designed to convert natural gas to naphtha, kerosene, gas oil, paraffins and wax. The synthesis gas for the gasification process is produced by partial oxidation of methane using pure oxygen.

Pure oxygen at 2,500 tonnes/day is produced by an air separation plant. It is understood that the explosion/detonation took place inside the N₂/O₂ separation column due to contamination (CO, NO or hydrocarbons).

Although the incident is still under investigation, the source of the contamination may have been due to the heavy haze in the region from forest fires. The air feed to the separation unit is water-washed and passes through a molecular sieve. Preliminary calculations, however, show that concentrations of contaminants as low as ppm in the inlet air feed could build up to kilogram quantities in the bottom of the fractionator.

Windows were broken 1.5 km away. Missiles landed in an adjacent liquefied natural gas (LNG) plant (500m away). One piece of metal (1.5 tonne) landed 800 m away.

Heavy damage occurred to the plant.

Fortunately, there were no fatalities and fortunately, the control room was designed for blast resistance.

Twelve injuries were reported on adjacent properties.

[separation equipment, damage to equipment, injury]

Lessons

The report stated the following recommendations:

Sites operating air separation units are to be made aware that contaminants can build up in these units to cause substantial explosions.

Source : ICHEME

Location : ,

Injured : 0 Dead : -

Abstract

A barge exploded whilst docked. Residual jet fuel was being vacuumed from the tanks and being emptied into a petroleum road tanker on a pier at the time of the explosion. The vessel had just delivered aviation fuel and the tank was being cleaned out for an new load of heating oil.

Investigations into the incident found three prime possibilities for the explosions.

Matches, which were found near the body of a crewman may have ignited the fuel vapours. Or one of the barge workers may have dropped and broken a flashlight, causing the blast. Another cause may have been due to the plastic hose which is used to vacuum the fuel accumulated enough static electricity to exploded the fumes.

Traces of alcohol were found in two of the crew members.

[river transport, cleaning, human causes]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 29 JULY, 1999. (<http://www.chemsafety.gov>).

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Location : Trainer, USA

Injured : 0 **Dead :** 0

Abstract

A 55-foot tank containing approximately 16,000 barrels of jet fuel exploded and burned at a refinery. Approximately 700,000 gallons of fuel burned for more than four hours before being brought under control. No deaths or serious injuries were reported.

[explosion, fire - consequence, refining]

Lessons

[None Reported]

Source : ENVIRONMENTAL TIMES, VOLUME 6, ISSUE 3, SPRING 2000.

Location : , UK

Injured : 0 Dead : 0

Abstract

Jet oil was seen to be shooting from a stationary tank in a continuous stream. The incident occurred due to valves on the tank being opened by vandals.

Approximately 150,000 litres of oil was released into the environment.

The valve designed to drain rainwater out and keep the bund at full capacity, had been left open and the oil was therefore able to run out and enter the ground.

The company was fined £10,000 and costs of £4,000 (2000).

[vandalism, spill]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A cooling tower, on an ethylene plant, had been prepared for person-entry. A fitter noticed paint blistering near to the middle entry door. The emergency services played water onto the tower externals until temperatures fell to 150 degrees C then the tower was repurged with nitrogen. Prior to the incident, the tower had been purged with nitrogen, then steam purge to remove traces of hydrocarbons, and cooled. An air purge was then used to assist cooling, and the last (middle) of three entry doors removed. It was whilst removing this door that the blistering paint was noticed. [pyrophoric carbon, iron sulphide, fire - consequence, autoignition]

Lessons

The tower had been shut down to investigate, and remove, blockages of coke and polymer. The coke is carried forward from upstream furnaces, and the polymer forms within the tower during normal operations. Before shutdown, several wash solutions, including xylene, were used to attempt to dissolve the polymer. None of these were successful in removing the blockage so a decision to open up the tower was taken.

Laboratory tests showed that washing with xylene produced fine, sooty carbon deposits that were self-heating in air at the temperatures in the tower. There could then self-ignite at 185 degrees C.

Also, traces of finely divided iron sulphide, also present in the xylene wash sampler, can be pyrophoric.

Either of these mechanisms could have led to glowing-hot sooty carbon, which then ignited the larger coke particles on the tower trays.

Manufacturing managers were recommended to review procedures for cleaning and opening (to air) equipment, containing material of a pyrophoric nature.

An outline procedure was developed, and referred to in the Report.

However, the procedure itself, was not included in the report received.

12226 July 1998

Source : CHEMICAL HAZARDS IN INDUSRTY, FEBRUARY 2000.

Location : Oxfordshire, UK

Injured : 0 **Dead** : 0

Abstract

An ink and varnish company was fined £10,000 (1999), for polluting a pond linked to a river with linseed oil.

An investigation into the incident found that the company's drainage system was full. A large volume of oil had collected in a bund protecting oil tanks.
[pollution, human causes, processing]

Lessons

[None Reported]

12767May 1998

Source : CHEMICAL HAZARDS IN INDUSTRY, JUNE 2000,; MADDEN, G. (SOUTH GLOSTERSHIRE ENVIRONMENTAL SERVICES, UK) ENVIRONMENTAL HEALTH JOURNAL, FEB 2000, 108(2), 46-48.

Location : Bristol, UK

Injured : 0 **Dead** : 0

Abstract

An underground fuel pipeline was damaged during planned maintenance work forcing two families to be moved out of their homes. Approximately 27,000 litres of kerosene were recovered following the incident. It is estimated that approximately 500-900 litres has been lost to ground. [evacuation, spill, excavation damage, damage to equipment]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A lube oil spillage occurred during the demolition of a redundant road tanker filling gantry due to inadequate isolation of the pipework. The redundant road tanker filling gantry consisted of numerous horizontally run overhead pipes that branched off from existing operational pipes going to other filling stations.

The demolition work was controlled under a permit-to-work that clearly required positive isolation of each filling line.

The permit considered the line in question to be positively isolated by a blind. Unfortunately due to the congestion of lines in the area, the line was mistakenly identified with an adjacent pipe which was fitted with a blind.

The fact that a blind had not been fitted or the ball valve was not in its closed position was not discovered until the main filling line was used again to the existing operational filling station.

The slop header could not cope with the flow of oil from the hose with the result that the tundishes overflowed onto the rail tracks and road. Approximately 8,500 litres of oil was

recovered by means of a vacuum truck or from the oily water sewer.

A further spillage occurred the following day. In spite of checking the position of the handles on the ball valves, it had not been identified or considered for the handles to be 90 degrees away from their normal position and no blinds had been fitted to the lines. The valve handles had been

modified sometime ago to enable a mechanical locking device to be fitted. Not only had the handles been modified, washers had been fitted which obscured the true position of the ports in

the valve itself. There was no way of determining whether the valve was open or closed and not all the valves had been modified. An inconsistent arrangement which was prone to human error. Approximately 4,500 litres was recovered from the second spillage under level control.

The immediate causes of the spillage was failure to positively isolate the pipes through shut and locked ball valves and the installation of blinds.

The basic causes were the failure to properly document previous modifications of the valve handles and failure to follow the correct isolation practices for demolition work before issuing work permits.

A contributory cause was a failure to carry out regular monitoring of the work permit system for this type of activity.

[isolation inadequate, design or procedure error]

Lessons

[None Reported]

1040725 December 1997

Source : LOSS PREVENTION BULLETIN, 139, 23.; THE CHEMICAL ENGINEER, 15 JANUARY 1998.

Location : Bintulu, Sarawak, MALAYSIA

Injured : 12 Dead : 0

Abstract

An explosion occurred in an air separation unit on a distillate plant. Several major pieces of plant equipment were found approximately 1.3 kilometres from the site of the explosion.

This explosion was consistent with airburst energy of approximately 36GJ, one of the largest ever land-based industrial explosions.

The explosion occurred in a cryogenic distillation column, which generates gaseous oxygen and was not related to the distillate synthesis process technology.

The explosive rupture of the column was caused by the massive runaway combustion of sections of the aluminium plate fin type main vaporiser, which is located in the bottom of the low-pressure column above a large inventory of liquid oxygen.

The aluminium is presumed to have been ignited by combustible material, probably formed from hydrocarbons originating from the inlet air, which are assumed to have accumulated undetected on the aluminium surface from the liquid oxygen circulation through the closed sections of the main vaporiser.

The exact mechanism by which the combustion was triggered is at present unknown, and is under detailed investigation.

The fire occurred in two of fourteen product tanks, which contained naphtha and kerosene.

[distillation, fire - consequence, cryogenic equipment]

Lessons

[None Reported]

Source : LOSS CONTROL NEWSLETTER, 1997.

Location : , TAIWAN

Injured : 2 **Dead :** 3

Abstract

An explosion and fire destroyed an LPG tank and nearby gas oil and fuel oil pipelines. Cigarettes and a bottle of wine were found at the site.
[storage tanks, fire - consequence, fatality]

Lessons

[None Reported]

Source : LOSS CONTROL NEWSLETTER, 1997.

Location : , ANGOLA

Injured : 5 **Dead :** 2

Abstract

A fire consumed a depot's entire stock of solvents and lubricants but was extinguished before spreading to fuel storage tanks at a nearby refinery. The fire was apparently caused by a short circuit.

[fire - consequence, fatality, storage equipment]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 5 Dead : 2

Abstract

Severe damage occurred to a steam turbine when a compressor on ammonia plant refrigeration failed killing two people and injuring five others.

The failure of the turbine rotor resulted in the steam, let down from 97 bar superheated at 496 degrees C, mixed with lubricating oil. The release enveloped five employees in the area of the turbine and compressor.

An investigation concluded that the incident was a result of a combination of errors, which occurred in a sequence which provided the opportunity for the turbine failure.

[damage to equipment, fatality, mechanical equipment failure, gas / vapour release, injury]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, 1997, NOV. UPI.

Location : Illinois, USA

Injured : 0 **Dead** : 0

Abstract

A fire occurred due to an explosion of a forklift truck LPG tank. The fire swept through the warehouse which was storing cardboard and paper. Fire fighters prevented the fire from reaching the store.

[fire - consequence, warehousing]

Lessons

[None Reported]

Source : LLOYDS LIST, 16 SEP, 1997, 2 OCT, 1997,; OIL AND GAS JOURNAL, 22 SEP, 1997,; THE CHEMICAL ENGINEER, 25 SEP, 1997,; THE GUARDIAN, 18 SEP, 1997.

Location : , INDIA

Injured : 20 **Dead** : 60

Abstract

A leak of LPG occurred on a pipeline whilst unloading a marine tanker causing an explosion and igniting six storage tanks, some containing kerosene. The fire burned for two days and damaged 19 tanks, a two storey office block and five other buildings. The smoke caused the port to be shut down and 100,000 people evacuated.

[fire - consequence, damage to equipment, fatality, evacuation]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, 1997, NOV. TRADE WINDS.

Location :

Injured : 0 Dead : 0

Abstract

A incident. An explosion and fire occurred in the engine room of a laden LPG carrier while at anchor.

[fire - consequence]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, 1997, NOV. LLOYDS LIST.

Location : , BELGIUM

Injured : 0 Dead : 0

Abstract

A marine transportation incident. Engine trouble occurred on a laden LPG tanker causing it to be grounded in a waterway.

[ship ran aground]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, 1997, NOV. OGJ,; LOSS CONTROL NEWSLETTER, 1997.

Location : Visakhapatnam, INDIA

Injured : 0 **Dead** : 56

Abstract

A pipe carrying LPG from harbour to refinery leaked setting off an explosion that triggered a fire which engulfed 18 storage tanks. Seven tanks containing LPG and crude oil were completely destroyed. 100,000 people were reported to have left the area following the incident. All within a 500 metre radius of explosion were killed. Pre-commissioning of one of the crude distillation units will begin in December, the second in January.

[fatality, refining, road tanker, damage to equipment, leak]

Lessons

[None Reported]

Source : LOSS CONTROL NEWSLETTER, 1997.

Location : , TAIWAN

Injured : 21 **Dead :** 7

Abstract

An explosion occurred during maintenance work involving moving an LPG pipeline.

It is thought the explosion occurred due to sparks from nearby motorcycle engines. The fire lasted 12 hours.

[fire - consequence, fatality]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, 1997, SEP. REUTER.

Location : , INDIAN OCEAN

Injured : 0 **Dead :** 0

Abstract

A marine transportation incident. A bulk carrier laden with iron ore was in collision with a sea mount, sever keel damage occurred, fortunately there was no pollution.

[damage to equipment]

Lessons

[None Reported]

Source : LOSS CONTROL NEWSLETTER, 1997.

Location : , CHINA

Injured : 64 **Dead :** 3

Abstract

A fire occurred as a result of an explosion which sent shards of metal cascading across neighbouring streets and shattered windows up to 1 km away. A fire in a petrol storage area had sparked the blast. Production of ethylene at the factory to be halted for approximately one year.
[fire - consequence, fatality, LPG, injury]

Lessons

[None Reported]

1135912 June 1997

Source : LLOYDS LIST, 13 JUNE, 1997,; CHEMISTRY IN BRITAIN AUGUST, 1997.

Location : , UK

Injured : 4 Dead : 0

Abstract

A fire occurred at an ink blending factory.

Hundreds of people were evacuated after a massive fire at a chemical plant when drums of printing inks exploded sending black clouds over the town. All 3 production units destroyed.

An investigation into the incident found that the probable cause of the fire was due to a faulty heater.

The fire destroyed 50% of the building and approximately 100 tonnes of printing ink, 90 tonnes of varnish and 30 tonnes of solvent.

A loss of £1.17 M (1997) was estimated.

[fire - consequence, explosion, evacuation, damage to equipment, mechanical equipment failure, normal operations, injury]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, 1997, AUG. LLOYDS LIST.

Location : California, USA

Injured : 0 **Dead :** 0

Abstract

A rail transportation incident. A freight train carrying LPG residue and phosphoric acid derailed. Nineteen cars left the tracks, no spill occurred. Resident were evacuated and gas and electricity supplies were cut off.

[derailment, evacuation]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, 1997, AUG. LLOYDS LIST.

Location : , JAPAN

Injured : 0 Dead : 0

Abstract

A marine transportation incident. An liquefied natural gas (LNG) carrier collided with a fishing vessel causing damage to the port side and bulwark.
[collision, damage to equipment]

Lessons

[None Reported]

Source : CHEMICAL HAZARDS IN INDUSTRY, 1997, NOV.

Location : Texas, USA

Injured : 0 **Dead :** 0

Abstract

An explosion and fire occurred in an alkylation unit releasing a mixture of propane, isobutane and HF (hydrofluoric acid/hydrogen fluoride) from a ruptured feed line. The HF was dispersed into the atmosphere by the fire's updraft. An estimated 20 barrels of HF was diluted by fire fighters.

Tests did not indicate an HF release in the surrounding neighbourhood.

[fire - consequence, leak, spill]

Lessons

[None Reported]

Source : LOSS CONTROL NEWSLETTER, 1997.

Location : , GERMANY

Injured : 0 Dead : 0

Abstract

A fire started when a mixture of isopropyl alcohol and a solvent ignited due to an electrostatic spark during the mixing of the two substances. Leaking solvents were responsible for the extension of the blaze to the production unit.

[fire - consequence]

Lessons

[None Reported]

9055 25 January 1997

Source : CNN.COM, U.S. NEWS, (<http://www.cnn.com>).

Location :

Injured : 12 Dead : 0

Abstract

An explosion occurred at a 400,000 tonne middle distillate synthesis plant causing severe damage to the plant. Two production tanks, one containing naphtha and the other kerosene were set on fire as a result of the explosion, the remaining eight product and two sludge tanks were cooled off to prevent any further possible spread.

The plant produces various products ranging from distillates to waxes, averaging 1,200 tonnes per day.

[damage to equipment, distillation]

Lessons

[None Reported]

Source : CHEMICAL HAZARDS IN INDUSTRY, 1997, SEP.

Location :

Injured : 1 **Dead :** 0

Abstract

LPG gas which leaked during tanker filling caused an explosion and fire at a depot. One worker who was loading the tank into the vehicle was burned and needed hospital treatment. A further 200 people were evacuated.

[fire - consequence, burns, road tanker, evacuation]

Lessons

[None Reported]

Source : CHEMICAL HAZARDS IN INDUSTRY, 1997, SEP.

Location : , UK

Injured : 1 **Dead :** 0

Abstract

A water supply station has been closed following contamination of a nearby stream with lindane. An open drum containing 20lbs of lindane powder was found in the stream. A woman who put her hands in the stream was burned and dead fish have been found. An emergency clean-up operation has been carried out.

[ecological damage, burns, drums, leak]

Lessons

[None Reported]

Source : CHEMICAL HAZARDS IN INDUSTRY, 1997, SEP.

Location :

Injured : 1 **Dead :** 0

Abstract

A located in a drain line of a diluent dryer at a polyethylene plant, blew out whilst the dryer was being prepared for registration. The operator was showered with glass and liquid isobutane, receiving minor cuts, a scratched eye and cold burns to the face. Possible causes of the incident were overpressure of the drain line or failure of the sight glass below its rated pressure. Neither of these was established as the cause of the accident.

[overpressurisation, blowout, draining]

Lessons

[None Reported]

8474 06 November 1996

Source : EUROPEAN CHEMICAL NEWS, 1996, NOV, 11.

Location : Northumberland, UK

Injured : 0 Dead : 0

Abstract

A fire occurred in a plant making ink resins and curing agents.

[fire - consequence, processing]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

An FCC Unit was shut down for 9 days following failure of the wet gas compressor turbine. Total loss was estimated at \$4.65 million (£2,776,119) (1996). The loss was caused by water contaminating the lubricating oil of the turbine driver. Water had entered the lube oil system through a defective steam ejector system that is an auxiliary part of the wet gas compressor's steam turbine driver. The FCC wet gas compressor was installed in 1971 and had two, long operating periods (12 years and 11 years) without an incident. On September 27, 1996, a short-term lube oil bearing temperature increase of 15 degrees F on the inboard end of the turbine was followed with a 70 degrees F fall in lube oil temperature. This was possibly the first indication of some loss of bearing material, which resulted in an increase in the bearing clearances allowing more oil to flow into the bearings. This increased flow resulted in the reduction of the lube oil temperature below normal level. On September 28, a decline in the turbine exhaust vacuum was discovered. This was rectified by adjusting the sealing steam and the condenser ejector system. The decline in vacuum was probably due to the increase in bearing clearance the previous day causing some minor degradation of the turbine labyrinth seals. The turbine exhaust steam vacuum was steady throughout the remainder of the week, until Friday, October 4. Again the sealing steam had to be adjusted to maintain proper vacuum. Operations continued normally until the morning of October 5. At 05:50 hrs. a vibration alarm came on in the control room. Operator response to the turbine-compressor train found excessive vibration on the turbine. The sealing steam pressures were abnormal and the turbine exhaust vacuum had declined. Adjustments failed to correct the vibration problem or the turbine exhaust pressure. Increased vibration and "sparks" from the packing box area of the turbine resulted in the decision to shut down.

The FCC steam turbine driven wet gas compressor was shut down owing to extremely high vibration, sparking from the inboard and outboard packing box and a total loss of turbine performance. Inspections carried out afterward on the turbine and compressor found the following:

1. The radial bearings were excessively worn, all babbitt was found removed and the rotor had operated on the bronze backing of the tilt pad bearings.
2. The shaft labyrinth seals were heavily damaged.
3. There was damage to the rotor blades at the 5th stage (severe) and on the 7th and 8th stages.
4. There was evidence of heavy rust in bearing housings and the oil lubricated coupling was fouled with rust and "blocked up."
5. The compressor itself was undamaged, but there was rust in the bearing housings and minor damage to thrust bearings.

Evidence of water contaminated lube oil throughout the system caused sludge and corrosion material build up in the bearings. The water came from a defective steam ejector system. Eight out of the 12 tubes of the gland condenser had failed; and since the condenser drain was plugged, it allowed the cooling water to flow back into the turbine seals and into the lube oil system.

The refinery took a number of corrective actions that included:

1. Repair of and modification to the ejector system.
2. Development of a proper lube oil monitoring system for all rotating equipment on site.
3. A review of other machine condition monitoring systems for bearings.
4. Development of a comprehensive training program including refresher training to ensure compressor - turbine auxiliary systems are fully understood.
5. Ensuring clear communications between operations and maintenance on the priority that should be given to monitoring and maintenance of critical equipment.

The immediate cause of the failure was the presence of water in the lubricating oil system which destroyed the ability of the lube oil to support the rotating equipment. The basic cause of the contamination was the leaking tubes on the associated with the auxiliary system ejector system combined with the plugged drain. In addition, the failure to identify and/or acknowledge a number of warning signals prior to the incident was also significant. The latter was attributed to training particularly the need for refresher training on the wet gas compressor's auxiliary systems.

[cracking, turbine, mechanical equipment failure, training inadequate, plant shutdown]

Lessons

1. Rotating equipment lubricating oil examination to detect contaminants to be a routine operation.
2. Use condition monitoring equipment to determine critical bearing performance, but be sensitive to other early warning signals.
3. Auxiliary systems are outside operations mainstream expected performance and so are easily overlooked. Refresher training is essential for these systems.

Source : ICHEME

Location : ,

Injured : 0 Dead : 1

Abstract

Contractor fatality during tank construction at an LPG terminal. A contractor's fitter working on a 3 m high catwalk for the erection of a water storage tank fell head-down into the bottom of the tank. It was found that the fitter was not using/standing on a proper platform. The time was approaching the end of the working day and, instead of rearranging the catwalk (wooded plank), he chose to balance with one foot on the pointed edge of a slender angle bar, which gave way. Fatality.

[safety procedures inadequate]

Lessons

Detailed discussion with tank constructors by the project teams on how safe working platforms are to be provided is obviously necessary before the work starts, and requirements must be written into the contracts and checked on throughout the project.

8601 June 1996

Source : LLOYDS LIST, 1996, JUN, 24.

Location : Kola Peninsula, RUSSIA

Injured : 0 **Dead** : 0

Abstract

Transportation. A spillage from a leak from a pipeline covered 30,000 sq. m. of lake and swamp with 400 tonnes of kerosene.
[environmental]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A vacuum unit had been shut-down for a planned overhaul. Steam-out of the vacuum column was completed, with the top and bottom manway doors opened. Early the following morning glowing hot spots were noticed on the outside of the insulation at a level just above the bed. There was damage to equipment. It was found that an exothermic reaction of pyrophoric material ignited combustible material present. Several possibilities exist within the system that could produce iron oxide corrosion scale.

[maintenance, fire - consequence, cracking]

Lessons

Pyrophoric iron sulphide must ALWAYS be assumed to be present in CDU, VDU, FCC, Coker and Visbreaker fractionators.

No matter how good the steaming out procedure, all CDU, VDU, FCC, Coker and Visbreaker fractionators must be assumed to contain combustible material.

8286 05 March 1996

Source : SEDGWICK LOSS CONTROL NEWSLETTER, ISSUE 2, 1996.

Location : Amsterdam, NETHERLANDS

Injured : 2 **Dead** : 0

Abstract

A fire occurred in a laboratory when a reactor was charged with lithium aluminium hydride.

[fire - consequence, reactors and reaction equipment, laboratory work, charging reactor]

Lessons

[None Reported]

8200 11 October 1995

Source : HAZARDOUS CARGO BULLETIN, 1995, DEC.

Location : Manu St., Otahuhu, NEW ZEALAND

Injured : 50 Dead : 0

Abstract

Toxic fumes spread over the town and inhabitants urged to attend the hospital if feeling unwell. The explosion and fire occurred in a blender which was mixing azinphos-methyl, an insecticide which is an organic phosphate. Little water used to restrict runoff. 700 evacuated.
[fire - consequence, evacuation, gas / vapour release]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, 1995, OCT.

Location : Rotterdam, NETHERLANDS

Injured : 1 **Dead** : 1

Abstract

A marine transportation incident. A marine tanker barge loading at terminal was struck by ro-ro ferry and sank. 10 tonnes of naphtha spillage to canal from damaged hull. Small LPG spillage. Fatality.

[collision]

Lessons

[None Reported]

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 3 RD QUARTER, 1995.

Location : Nagaoka, JAPAN

Injured : 0 **Dead** : 0

Abstract

Transportation. The 350 mm, 23.5 km liquefied natural gas (LNG) pipeline was ruptured by a landslide caused by heavy rains in the area. A four hour fire resulted.

[fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A substantial carryover of kerosene occurred from a section of the plant into the flare system. Liquid flowed from the overflow pipe at the base of the flare into the sewer system. The sewer overflowed and some 30 m³ (cubic metres) spilled around the flare stack.

It was found that during water wash of the clay treater, the outlet valve of the treater was left in the open position. The incident was caused because the flushing operation for the clay treaters was not documented as a procedure.

[cleaning inadequate]

Lessons

Operating procedures and job tasks need to be evaluated and available in written format.

Checklists for verifying vessel isolations are useful.

7614 01 July 1995

Source : HAZARDOUS CARGO BULLETIN, 1995, SEP.

Location : Koje Island, Korea Straight, SOUTH KOREA

Injured : 0 **Dead** : 0

Abstract

A marine transportation incident. Gas carrier with 871 cum (cubic metres) of LPG sank.

Lessons

[None Reported]

1779 01 July 1995

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 3RD QUARTER, 1995.

Location : Yaroslavl, RUSSIA

Injured : 1 **Dead** : 0

Abstract

A fire at an oil refinery probably occurred due to a spark during maintenance work. Three out of four LPG tanks were destroyed and the fourth was expected to burn out shortly after.

[fire - consequence, refining]

Lessons

[None Reported]

3177 30 June 1995

Source : LLOYDS LIST, 1995, JUL, 1.

Location : Dunlin A, North Sea, UK

Injured : 0 **Dead** : 0

Abstract

A fire occurred in a generator room which was caused by a lubricating oil leak from a turbine gasket.

[fire - consequence, processing]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Oil spill at a dock at a refinery. During the transfer of lube oil back into the refinery for reprocessing, the discharge hose compression fitting at the flanged connection to the existing pipework failed, resulting in a major loss of oil containment. It was found that the hose, supplied by a third party, contained a fabrication defect. The cause was due to the failed fitting ferrule not being tight enough and the swaging dolly was too small.
[material transfer, refining, flange failure]

Lessons

If necessary to use hoses supplied by third parties, they should only be used when their history is known and the hose tested before use.

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 2ND QUARTER, 1995.

Location : Onitsha, NIGERIA

Injured : 0 **Dead** : 20

Abstract

A road tanker explosion while unloading LPG. The explosion caused a panic in the area in which several people were crushed by motorists fleeing the scene.
Fatality.

Lessons

[None Reported]

Source : SEDGWICK LOSS CONTROL NEWSLETTER, ISSUES 2, 1995.

Location : Port Harcourt, Rivers State, NIGERIA

Injured : 0 **Dead :** 0

Abstract

Transportation. Gas supply interrupted by explosion on pipeline which carries liquefied petroleum gas (LPG). It was reported that the fatalities were saboteurs who were killed by the unexpected force of the explosion.

[sabotage]

Lessons

[None Reported]

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 2ND QUARTER, 1995.

Location : Edgeworthstown, County Longford, IRELAND

Injured : 0 **Dead** : 0

Abstract

A road transportation incident. A road tanker containing 20,000 litres of LPG came off the road at a bend into the village and ended in the front garden of a house. Gas leaked from the tanker and about an hour later ignited and destroyed the house.

[explosion, fire - consequence, damage to equipment]

Lessons

[None Reported]

8103 23 March 1995

Source : LLOYDS LIST, 1995, APR, 8,; HAZARDOUS CARGO BULLETIN, 1995, MAY.

Location : Dikson, RUSSIA

Injured : 0 **Dead** : 0

Abstract

Pipeline ruptured at storage tank under weight of snow at airport. 1,800 tonnes of jet fuel poured over snow and ice, and then in the sea.
[storage tanks, weather effects, spill]

Lessons

[None Reported]

Source : SEDGWICK LOSS CONTROL NEWSLETTER, ISSUE 1, 1995.

Location : Chiapas, MEXICO

Injured : 22 Dead : 1

Abstract

Transportation. Flames leapt 50 m in the air following an LPG pipeline explosion, causing knock-on damage and secondary explosions at two other pipelines.

Fatality.

[fire - consequence, damage to equipment]

Lessons

[None Reported]

Source : CHEMICAL HAZARDS IN INDUSTRY, JUNE 2000.

Location : , JAPAN

Injured : - Dead : -

Abstract

Liquefied petroleum gas (LPG) leaked from a storage tank following an earthquake forcing the evacuation of nearby residents.

The leak rate increased with subsequent aftershocks. An investigation into earthquake prevention measures found that the leak came from the piping system connected to the tank.

[spill, storage tanks]

Lessons

The following recommendations were made for earthquake-resisting measures include:

Flexibility of high-pressure gas piping systems.

Improve planning layout.

Protection of auxiliary facilities and improvements in disaster prevention management and emergency response.

1023 15 January 1995

Source : LLOYDS LIST, 1996, JAN, 26.

Location : Angarsk Region, RUSSIA

Injured : 0 **Dead** : 0

Abstract

Transportation. About 350 cum (cubic metres) of kerosene spillage from ruptured 300 mm pipeline.

Lessons

[None Reported]

8140 06 January 1995

Source : SEDGWICK LOSS CONTROL NEWSLETTER, ISSUE 1, 1995.

Location : El Segundo, California, USA

Injured : 0 **Dead** : 0

Abstract

A fire started in the furnace area of a kerosene treatment unit within this refinery during a maintenance period. One month down time expected.
[fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Jet fuel tank spill at a refinery. During a period of low ambient temperatures, the sight glass on a storage tank water drainage piping failed, and 8,200 bbls. of Jet A fuel was released. The sight glass failed due to expansive forces as water in piping froze. There was also deviation from procedure when water was not being drained. The basic cause was poor design of electric heat tracing which did not prevent water inside draw piping from freezing and there was inadequate procedure for isolating water draw-off.

[weather effects, storage tanks, isolation inadequate, aviation fuel, gauge glass failure, jet fuel]

Lessons

Job task observation is required to ensure that intended operational procedures are, in fact, followed.

6791 18 December 1994

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 4TH QUARTER, 1994.

Location : Martinez; California, USA

Injured : 0 **Dead** : 0

Abstract

Small fire in hydrocraker at a refinery resulting from gasket failure in lubricating oil system.

[fire - consequence, refining]

Lessons

[None Reported]

6733 19 October 1994

Source : OIL & GAS JOURNAL, 1994, 26 DEC., 27.

Location : Torrance; California, USA

Injured : 21 Dead : 0

Abstract

LPG pipeline was being brought back on line after maintenance work when there was a leak at a flange which ignited.

[flange leak, fire - consequence, start-up, inspection inadequate]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 123, 13-14.

Location : ,

Injured : 1 Dead : 0

Abstract

When heating synthetic tar in a portable kettle to repair the roof of a maintenance shop. A worker draining tar from the kettle into a bucket noticed that the surface of the tar had caught fire in the bucket. As he moved backward, the handle stuck to his glove and the bucket tipped over, spilling the burning tar on the ground. The tap on the kettle did not close as designed, allowing additional hot tar to drain and causing the fire to spread. The fire engulfed the tar kettle trailer and an adjacent utility trailer that held a 100 litre liquefied petroleum gas (LPG) cylinder. When the LPG cylinder exploded, the end cap was hurled about 40 metres, causing a small grass fire. A second LPG cylinder in the vicinity vented but did not explode. One worker sustained first degree burns to his forearm from splattered tar. The site fire crew were called to the scene to extinguish the fire. Damage amounted to the total loss of the tar kettle, the adjacent utility trailer, and the two 100 litre LPG cylinders.

[explosion, fire - consequence, damage to equipment]

Lessons

The following steps should be taken to prevent or control fires associated with roof fires.

1. Identify and communicate all potential hazards before work begins.

This process is particularly important when unseen hazards exist, such as the presence of flammable vapours. Precautions to ensure that materials do not reach their flashpoints should be planned and executed. All required thermometers, thermostats, and other safety devices for heating equipment should be routinely inspected by qualified personnel.

2. Control hazardous materials on the job site.

This should include co-ordination of concurrent work so that hazards are recognised and minimised. Ensure that nearby workers are not exposed to hazards.

3. Develop fire protection plans that will minimise the potential for roof fires and ensure their control.

4. Plans for responding to potential roof fires should include controlling a fire to prevent its spread to other areas.

6662 10 August 1994

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 3RD QUARTER, 1994.

Location : La Plata, ARGENTINA

Injured : 0 **Dead** : 0

Abstract

1.7 million litres of lubricating oil spilled as a result of suspected sabotage.

Lessons

[None Reported]

6649 05 August 1994

Source : CIVIL PROTECTION, 1994, AUTUMN.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994 OCT.

Location : Avonmouth, UK

Injured : 1 Dead : 1

Abstract

A port worker was killed in a fire at a fuel pipeline at dock. Fire spread to Kerosene in tanks at the storage depot and burned for 18 hours. Fatality.
[fire - consequence]

Lessons

[None Reported]

6624 09 July 1994

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 3RD QUARTER, 1994.

Location : Pt Arun, INDONESIA

Injured : 0 **Dead** : 0

Abstract

Plant shutdown following a break in a pipeline leading to liquefied natural gas (LNG) plant.

[gas / vapour release]

Lessons

[None Reported]

6618 05 July 1994

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 3RD QUARTER, 1994.

Location : Antwerp, BELGIUM

Injured : 0 **Dead** : 0

Abstract

A marine transportation incident. An LPG marine tanker destroyed a jetty during berthing and damaged pipelines. Gas escaped but did not ignite.
[collision, damage to equipment]

Lessons

[None Reported]

8439 01 July 1994

Source : ICHEME

Location : , RUSSIA

Injured : 1 Dead : 0

Abstract

An isobutane leak during repairs in the control room of an alkylation unit ignited and caused an explosion.

Lessons

[None Reported]

6603 26 June 1994

Source : LLOYDS LIST, 1994, 25 JUN.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, AUG.

Location : A'amshite; Byblos Area, LEBANON

Injured : 28 **Dead** : 8

Abstract

Explosion and fire at fuel storage and gas depot after LPG from overfilled cylinder, at a filling machine, was ignited by a road truck engine. Gas cylinders exploded. Fatality.

[overflow, fire - consequence]

Lessons

[None Reported]

6577 23 June 1994

Source : CIVIL PROTECTION, 1994, AUTUMN.; HAZARDOUS CARGO BULLETIN, 1994, AUG., 72-74.; LLOYDS LIST, 1994, 25 JUN.

Location : Gatwick, UK

Injured : 45 **Dead** : 0

Abstract

Spillage from drums of insecticide at airport cargo building.

[transportation]

Lessons

[None Reported]

6579 01 June 1994

Source : LLOYDS LIST, 1994, 3 JUN.

Location : El Hadjar, ALGERIA

Injured : 2 **Dead** : 0

Abstract

Huge explosion at iron ore plant.
[processing]

Lessons

[None Reported]

6547 10 May 1994

Source : LLOYDS LIST, 1994, 12 MAY.

Location : Immingham, UK

Injured : 2 **Dead** : 0

Abstract

Magnesium granule plant fire while being prepared for maintenance.

[fire - consequence]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, JUL.

Location : Strait Of Malacca, MALAYSIA

Injured : 0 **Dead** : 0

Abstract

A marine transportation incident. Collision of a marine tanker with a bulk carrier in a thunderstorm led to the tanker being holed in 2 tanks and 400 tonnes of jet fuel and gas oil to be spilled to the sea.

[weather effects]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A release of crude oil causes shutdown of a crude distillation unit at a refinery. Spill.

The incident occurred when a loss of lubricating oil pressure caused the turbine driven desalted crude oil pump to shut down. Pressure build up and unsuccessful attempts to start/re-start pumps led to mechanical equipment failure of the relief valve's bellows and failure of adjoining piping. It was found that carbon steel tubing, which transmits the lubricating oil system pressure failed. The cause was found to be lack of preventive maintenance and inspection schedules for tubing. In addition pump modifications conflicted with its design and the pump was not tested before being returned to service.

Losses: production loss \$1.7 million (1994), local claims \$10,000 (1994), equipment damage \$160,000 (1994).

[process causes, design or procedure error, maintenance inadequate, refining, mechanical equipment failure, maintenance inadequate]

Lessons

Start-up and change-over switching arrangements for parallel pumps need to be routinely tested and available to operators. Modification to switching arrangements need to be agreed by all concerned and documented.

Source : ICHEME

Location : ,

Injured : 4 Dead : 0

Abstract

Three contractor employees and one company employee were exposed to a mixture of isobutane and hydrofluoric acid (HF). The amount of HF released was estimated to be less than the equivalent of one pound.

The release, in a small vapour cloud was as the result of breaking containment on a three quarter inch line being replaced during the turnaround.

Although during the emergency there was found to be a failure of the safety showers, quick and effective response by the refinery emergency response team prevented the incident from escalating into a major event. All four casualties were hospitalised, but they were released the next day.

Two were treated for HF burns, and two received precautionary treatment for HF inhalation. Subsequent investigation determined that plugging of the line had inhibited effective line purging, leading to the release after breaking line containment. Once the work permit had been issued, vague instructions, as well as questionable practices, compounded the magnitude of the incident.

[gas / vapour release, permit to work system inadequate, safety procedures inadequate,]

Lessons

The following recommendations were made:

It is essential that systems which have been purged to allow them to be worked on by maintenance be verified as clear before containment is broken.

Techniques used by workers to cut into/open, equipment/lines should be done in such a way as to limit any spillage/leakage as far as possible in addition to the verification by operations personnel.

Safety showers must be regularly checked as being operating correctly. These must not be isolated while any possible need for their use exists on the plant; e.g., usually throughout the turnaround.

HF Alkylation Plants must ensure that they have an adequate emergency response to deal with accidental exposure of personnel to HF, both for burns and respiratory problems. Liaison with outside medical services/hospitals is essential to ensure that correct treatment is rapidly available, with the necessary aftercare.

6452 06 March 1994

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 1ST QUARTER, 1994.

Location : Harlow, UK

Injured : 0 Dead : 0

Abstract

Fire within factory producing printing inks.

[fire - consequence, processing]

Lessons

[None Reported]

6451 06 March 1994

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, MAY.

Location : , GULF OF THAILAND

Injured : 0 **Dead :** 0

Abstract

A marine transportation incident. A bulk carrier was in collision with a marine tanker loaded with diesel and LPG. 425 tonnes of diesel spilled to the sea.

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, MAY.

Location : Muringur; Nr Cochin; Kerala, INDIA

Injured : 0 **Dead** : 0

Abstract

A rail transportation incident. Derailment of 28 rail cars including rail tankers of diesel and kerosene led to a fire. Sabotage has been ruled out.
[fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 4 Dead : 0

Abstract

Hydrofluoric acid exposures at a refinery. Upon breaking containment on a inch pipeline being replaced during turn-around, a small vapour cloud of isobutane and HF (hydrogen fluoride) (approximately one pound) was released, exposing four persons. It was found that the line was inadequately purged. The cause was inadequate procedures for ensuring that a line had been purged, and unclear instructions given to work team.

[operation inadequate, gas / vapour release, refining]

Lessons

A physical verification of purging must take place for all lines which are to undergo hot work.

6437 25 February 1994

Source : LLOYDS LIST, 1994, 26 FEB.

Location : Delmenhorst, GERMANY

Injured : 0 Dead : 0

Abstract

Fire in manufacturing unit where linoleum cement is made from linseed oil and balsamic resin.

[fire - consequence, processing]

Lessons

[None Reported]

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 1ST QUARTER, 1994.

Location : Valdez, USA

Injured : 0 **Dead** : 0

Abstract

Small fire due to ignition of lubricating oil at a marine storage terminal.

[lube oil, fire - consequence]

Lessons

[None Reported]

6364 01 January 1994

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, MAR.; LLOYDS LIST, 1994, 15 JAN., & 29 JAN, & 9 FEB.

Location : Merseyside, UK

Injured : 0 Dead : 0

Abstract

A marine transportation incident. Chemical spill caused pollution of coast. Identified as coming from chemical tanker washing tanks from lube oil additive.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Isobutane release at a refinery. A vapour cloud of isobutane and water was released from an isobutane cooler (exchanger). The release was contained and the leak isolated. It was found that the water side of the exchanger froze, resulting in gasket failure between shell and channel cover. Internal failure permitted isobutane to flow into the water side of the exchanger, this mixture of isobutane and water was released through the damaged gasket and from the steam vents which are part of the cooling water return system. The basic cause was a lack of a formal procedure for isolating and winterising the exchanger when it was not being used.

[weather effects, cooling equipment, spill, isolation inadequate, refining]

Lessons

Formal procedure for winterising this equipment should be established.

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, MAR.

Location : Rio De Janeiro, BRAZIL

Injured : 0 **Dead** : 0

Abstract

A marine transportation incident. A marine tanker grounded with 200 tonnes lube oil additive and 500 tonnes brake fluid. Transferred to another tanker with no spillage.

[near miss, ship ran aground]

Lessons

[None Reported]

6323 29 November 1993

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, JAN.

Location : Ulsan, SOUTH KOREA

Injured : 10 **Dead** : 6

Abstract

Hot work was being carried out on this LPG carrier. A massive explosion ruptured one of the tanks and holed the deck plates. Fatality.
[marine transport]

Lessons

[None Reported]

6308 19 November 1993

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 4TH QUARTER, 1993.

Location : El Paso; Texas, USA

Injured : 0 Dead : 0

Abstract

Fire in isobutane isomerisation unit.

[fire - consequence, processing]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A near miss incident occurred when there was an escape of butylene during the cutting of a 4 inch LPG pipeline near a FCCU battery limits. A contractor's workman cutting the line became aware that the line was not gas free, stopped work and reported the incident to the control room. The gas alarm was raised and measures taken to contain the gas release.

The "all clear" was given after making some repairs to the pipeline, however, a few minutes later gas leaked from the line and the alarm was again raised. The situation was successfully dealt with and the all clear finally given half an hour later. Ignition did not occur, there was no damage or injury to personnel. The incident was reported to the authorities and local fire brigade.

[maintenance, leak,

Lessons

The report stated the following recommendations:

It is essential to gas free and prove by checking every part of a pipeline system before handover for modification; e.g., cutting into the system.

When venting down LPG systems the possibilities of forming ice plugs in the system, leading to a false conclusion that the pressure has been vented down satisfactorily, must always be allowed for and precautions taken to avoid.

The importance of employing contractors with sufficient knowledge to stop work

when an unexpected situation arises is clearly demonstrated in this incident.

The incident could have been much more serious if "hot work" had been in progress.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

An explosion occurred in a spent caustic soda tank, separating the roof from its shell. A fire developed within the tank. It is likely that a C3/C4 hydrocarbon mixture entered the tank, and was ignited by glowing from the exothermic oxidation of pyrophoric iron sulphides. Analysis of the movements of the tank over the previous 6 months showed that conditions were right for the formation of pyrophorics, and this suggests that there should have been better monitoring of the tank. Review of the process unit where jet fuel is in contact with caustic, with the aim of minimising running down spent caustic contaminated with jet fuel. [unwanted chemical reaction, contamination]

Lessons

C3/C4s have been put into spent caustic soda tanks in the past, and the nature of sulphided caustic is such that the formation of pyrophoric deposits must be considered as possible.

This incident demonstrates the careful watch that needs to be kept on the vapour space of such tanks and the introduction of air during withdrawals. Some tanks may be inert gas blanketed; however, this is likely to promote pyrophoric production. The ideal is an atmosphere in the tank vapour space which is too low in oxygen content to support combustion, but high enough in oxygen to inhibit pyrophoric iron sulphide production, a philosophy that can be applied to sulphur and bitumen rundown tanks. However, this degree of control is not easy to achieve in practice.

6193 18 August 1993

Source : EUROPEAN CHEMICAL NEWS, 1993, 4 OCT.; LLOYDS LIST, 1993, 20 AUG.; CHEMICAL ENGINEER, 1993, 16 SEP.

Location : Charleston; West Virginia, USA

Injured : 30 **Dead** : 1

Abstract

Explosion in reactor cooler in plant making insecticide and nearby chemicals were ignited. Cloud of irritant fumes. Fire-water runoff contaminated river. One victim inhaled hydrogen cyanide gas thought to have been produced when chlorine acetoaldoxime and hydrochloric acid came into contact. Debris from explosion slightly damaged storage tank containing methyl isocyanate. Fatality.
[heat exchanger, cooling, pollution, methyl isocyanate, acetoaldoxime]

Lessons

[None Reported]

6192 17 August 1993

Source : LLOYDS LIST, 1993, 19 AUG.; EXECUTIVE NEWS, 1993, 17 AUG.

Location : Antwerp, BELGIUM

Injured : 2 Dead : 2

Abstract

Fire at lubricating oil plant. Explosion wrecked storage cylinders. Led to the evacuation of several streets. Fatality.

Lessons

[None Reported]

6185 10 August 1993

Source : LLOYDS LIST, 1993, 13 AUG.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, OCT.

Location : Tampa Bay; Florida, USA

Injured : 0 **Dead :** 0

Abstract

A river transportation incident. Collision between inbound pusher tugs and tank barges with 1670 tonnes of jet fuel engulfed in flames and ablaze for 14 hours. Subsequently barge carrying 6000 tonnes of phosphates hit barge and 70 tonnes of fuel oil spilt.

Lessons

[None Reported]

6182 06 August 1993

Source : LLOYDS LIST, 1993, 9 SEP.; EUROPEAN CHEMICAL NEWS, 1993, 27 JUN., & 16 AUG.; CHEMICAL ENGINEERING, 1993, SEP.; THE CHEMICAL ENGINEER, 1994, 10 NOV.

Location : Ringskidly; Cork, IRELAND

Injured : 5 **Dead** : 0

Abstract

Several explosions in pharmaceutical plant. Explosion resulted from a build-up in pressure when isopropanol was left in a process vessel for 6 days during the plant's annual shut-down. The vessel was insulated and the heat created by the residue of other chemicals at the bottom of the container could not escape.

[high pressure, reaction vessel]

Lessons

[None Reported]

6154 16 July 1993

Source : LLOYDS LIST, 1993, 17 JUL.

Location : Henin-beaumont, FRANCE

Injured : 3 **Dead** : 9

Abstract

Cloud of zinc dust exploded in lead and zinc factory as workers were dealing with an abnormal pressure in one of the zinc refining towers. Fatality.
[dust explosion, incorrect pressure]

Lessons

[None Reported]

9041 15 July 1993

Source : ENVIRONMENTAL PROTECTION BULLETIN, 030, 24-25.

Location : Near Dartford, UK

Injured : 0 Dead : 0

Abstract

An oil slick (less than 500 litres) was found coming from an underwater cooling water discharge to the middle of a river. The local authority sent out an inspector to investigate. On arrival the inspector could see no oil on the river, but he did find a small slick of oil beyond the final barrier of a surface oil water separator. The system treats general surface oily water drainings from the station, sending the cleaned water to a small creek, which in turn discharges to the river. Both the creek and the river are controlled waters.

Investigations began early the next day. The oil in the final separator to the creek in no way corresponded to the oil loss reported.

The power station, for some days previously had noticed a loss of lube oil from a reservoir that serves a number of lubricating and cooling oil duties on a No.1 generating set. Oil from the reservoir is pumped to bearings and seals and returned to the reservoir through a water cooler for re-use. Oil loss from the reservoir was not easily or immediately detectable, as the peak lopping operation and temperature changes cause big natural variations in oil level. However, for several days before the oil loss was reported, the station had been taking water samples for traces of oil. The day before the incident, oil had been detected in the water from a cooler associated with the hydrogen seal oil system on No. 1 set, and the equipment was valved off. It was subsequently found that leaks may have continued for a further period until the cooler was spaded off. The oil source had been found.

The cause of the spill was due to corrosion in the cooler water box body which had displaced a neoprene seal and permitted oil leakage. The sealing ring was out of position for about one fifth of its circumference. Looked into more closely, when the distance ring for the two neoprene rings was cleaned, weep holes were found in the circumference. The idea for this was to show leakage by an outward display of oil. The holes were all blocked and the main reason was that aluminium had been chosen, a totally unsuitable material for a ring on a saline water duty. The operator had been unaware that such ring holes existed. The operating manual was incorrect, it did not show weep holes. After the investigation the station revised their oil loss from 500 litres to 2,000 gallons (10,000 litres).

Lessons

[None Reported]

6142 05 July 1993

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, SEP.

Location : Off Marsa El Brega, LIBYA

Injured : 0 **Dead** : 0

Abstract

A marine transportation incident. Fully refrigerated LPG marine tanker carrier loaded with anhydrous ammonia grounded. Ship offloaded to another ship and refloated.

[ship ran aground]

Lessons

[None Reported]

6141 05 July 1993

Source : EVENING GAZETTE, 1993, 5 JUL.

Location : Seal Sands; Cleveland, UK

Injured : 0 **Dead** : 0

Abstract

LPG pipeline outside chemical company ruptured and ignited.

[fire - consequence]

Lessons

[None Reported]

6066 07 May 1993

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, JUL.

Location : , HONG KONG

Injured : 2 Dead : 0

Abstract

Explosion during welding after launch on bow deck of diesel/kerosene marine tanker barge at repair yard.

Lessons

[None Reported]

6058 01 May 1993

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, JUL.

Location : Off Worthing; Sussex, UK

Injured : 0 **Dead** : 0

Abstract

A marine transportation incident. Collision in fog and bow penetrated marine tanker below waterline leading to a spill of tonnes of lubricating oil.

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, JUN.

Location : Tanguingui, PHILIPPINES

Injured : 0 **Dead** : 0

Abstract

A marine transportation incident. A marine gas tanker loaded with 1003 cubic metres of LPG capsized and sank. Planned to flare off tank.

Lessons

[None Reported]

6033 16 April 1993

Source : LLOYDS LIST, 1993, 22 APR.

Location : Aktyuz, KAZAKHSTAN

Injured : 0 Dead : 0

Abstract

Pipeline from oil dressing factory burst resulting in lead, zinc, cadmium and molybdenum leaking into waters of a river.
[spill, processing]

Lessons

[None Reported]

Source : CHEMICAL HAZARDS IN INDUSTRY, 1993, JUN.

Location : Heerhugowaard, NETHERLANDS

Injured : 0 **Dead :** 0

Abstract

A fire that destroyed a production laboratory is thought to have originated when reagent was added to a mixture with isopropyl alcohol, causing a violent reaction and the release of foam. The foam ignited for a reason not yet known, and a 200-litre vessel containing acetone subsequently shattered, causing the fire to burn more strongly. This was the first time that the reaction had been carried out on an expanded scale, and foam production had not occurred when the process was performed on a laboratory scale.

[unwanted chemical reaction, fire - consequence, laboratory work]

Lessons

[None Reported]

5997 24 March 1993

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, MAY.

Location : Leverkusen, GERMANY

Injured : 0 **Dead** : 0

Abstract

Isophorodiamine entered water purification tanks after tank cleaning. Pollution alert issued.

[spill]

Lessons

[None Reported]

5992 19 March 1993

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, JUN.

Location : Runcorn Near; Cheshire, UK

Injured : 0 **Dead** : 1

Abstract

A road transportation incident. Collision with car caused a road tanker carrying kerosene to plunge onto main rail line causing explosion and fire after rail power lines ignited fuel. Fatality.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A fire occurred on the roof of a CS₂ recovery plant. The damage to the plant was minor, confined to equipment located on the roof. The bitumen covering on the roof was burned.

Stripper vapour lines, from condensation plant, had been isolated inadvertently, the valve indication showing the valve to be 'closed' when in fact it was open.

A pressure trip, designed to cut off the steam supply, automatically, in such circumstances, failed to work.

The plant became pressurised and a mixture of CS₂ and kerosene was ejected onto the roof, where it ignited.

A technical investigation was carried out to:

1. Determine the causes of the incident.
2. Make short term recommendations for the safe re-start of the plant.
3. Generate ideas for longer term actions.

[fire - consequence, leak, safety equipment failure, instrument/controller, normal operations]

Lessons

1. Changes to the control system to make the plant easier to operate
 2. Upgrade of the valve
 3. Modification to the plant to eliminate continuous emissions of kerosene spray
 4. To improve the training, and understanding of the plant, of both managers and operators
-

5946 08 February 1993

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, APR.

Location : Lahore, PAKISTAN

Injured : 7 **Dead** : 14

Abstract

Explosion in ground floor shop during illegal overnight transfer of LPG into small cylinders. Fatality.
[material transfer, deliberate acts]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, FEB.

Location : Chongju, SOUTH KOREA

Injured : 0 **Dead** : 0

Abstract

Fire detonated LPG storage tanks in basement of 4 storey apartment block and levelled building.

[fire - consequence]

Lessons

[None Reported]

Source : CHEMICAL HAZARDS IN INDUSTRY, 1994, MAR.

Location : West Virginia, USA

Injured : 1 **Dead** : 1

Abstract

Explosion and fire at insecticide plant. Fatality.

[processing]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, 1994, JUL.

Location : Saint John; New Brunswick, CANADA

Injured : 0 **Dead** : 0

Abstract

A rail transportation incident. 10 rail tanker cars of LPG ran free from yard and ended on the main line. They ran free over one public and two private crossings.

[near miss]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

An isocracker at a refinery had an unscheduled shutdown for inspection of the catalyst bed in the 2nd stage reactor due to the development of a high pressure drop across the reactor.

The unit shutdown for catalyst change had been scheduled for March, 1993, but the high Delta P across the reactor even at reduced throughputs was so high as to cause concern regarding possible grid support failure in the reactor, which could have caused a serious incident with possible loss of containment.

The high pressure drop was found to be due to a four-inch layer of soft crust material, mostly consisting of iron sulphide. This corrosion product material had passed through the feed filter which had a coarser element installed than previous.

[reactors and reaction equipment, incorrect pressure, equipment causes, plant / property / equipment,

Lessons

The report stated the following recommendation:

Monitoring of systems should detect changes in corrosion rates to allow preventative actions to be taken.

5867 01 December 1992

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 1ST QUARTER, 1993.

Location : Ankara, TURKEY

Injured : 0 Dead : 22

Abstract

A road transportation incident. A road traffic accident involving a road tanker of LPG resulted in a large fire and explosion. Fatality.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

High pressure drop isocracker reactor. Periodic pressure measurements on the first bed of the second stage reactor revealed pressure drops greater than the maximum allowable. The unit was shutdown ahead of schedule to change the catalyst. A blockage caused by a 4-inch layer of soft crust material, forming a brick-and-mortar pattern between catalyst particles, developed in the reactor causing the high pressure drop. The primary basic cause was corrosion of upstream low-chrome steel plant that had deposited fine iron sulphide particles on the top bed. The secondary cause was that a coarser filter element had recently replaced a fine element on feed stream, allowing more particles to filter through.

Actual Losses Production losses, \$926,000 (1992), labour, \$70,000 (1992), materials, \$414,000 (1992).

[product loss, low pressure, reactors and reaction equipment, cracking]

Lessons

Monitoring of systems should detect changes in corrosion rates to allow preventative actions to be taken.

Changing filter element mesh sizes should be subject to technical considerations and approval. Apart from operational problems, different filter mesh sizes may not be adequate.

If too coarse, may produce excessive static electric charge; if too fine, etc.

Source : THE CHEMICAL ENGINEER, 1992, 10 DEC.

Location : Long Beach; California, USA

Injured : 0 **Dead** : 0

Abstract

One storage tank destroyed and many damaged in fire. So much water was used that the bund wall was breached and the water and petroleum mixture spilled into the storm sewers and the river. Substances involved: gasoline and LPG.

[fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 1 Dead : 0

Abstract

Preparation was in progress to isolate condensate sources to the acidic damaged Alky Condensate Flash Pot. An operator was in the process of switching from the turbine driven charge pump to the electric driven pump.

The operator checked the line-up for the pump, opened the discharge valve on the pump, and then started it. He then opened the isolating valve for the discharge pressure gauge. As he watched the discharge pressure increase, a hydrocarbon/acid release occurred from an open bleeder valve down-stream of the discharge pressure gauge. The operator was unable to close the bleeder valve due to icing and a large vapour cloud was released.

The operator returned to the control room to report the release and to put on a "D" suit. The operator in the control room activated the unit fire sprays and unit evacuation alarm, and reported the emergency over the radio. He also pulled the circuit breaker for the pump in the motor control centre and closed the electric operated EOV on the suction of the Depropaniser Charge Pumps.

The outside operator returned to the pump but was unable to close the valve on his first attempt due to the cloud in the air, the iced up valve, and that the front of his "D" suit was icing and restricting his vision. He returned to the control room, and the operator told him to try and close the pump discharge valve. He then re-entered the area and after climbing above the pump area to assess the situation, he was then able to close the main discharge valve on the pump and after the release stopped and the ice thawed the bleeder valve.

The maintenance leadman in the area saw the vapour release and used a water hose to knock-down the vapour, but as he was returning towards the pump alley the fire sprays in the unit were activated which pushed part of the cloud towards him. Retreating from the unit, and trapped in the cloud he inhaled some of the mixture. Emergency response was immediate, and oxygen was administered on the way to the Medical Centre. He was sent to hospital for chest x-rays, treated with Calcium Gluconate Aerosol and released.

The incident was under control in approximately 15 minutes, the electric driven depropaniser charge pump restored, and the unit returned to normal operation within about 2 hours.

The release volume was 2,700 lb of propane, isobutane, and hydrofluoric acid, the mixture containing 50 lb of the latter. No plant damage was caused by the incident.

[gas / vapour release, isolation inadequate, operational activities]

Lessons

The following recommendations were made:

1. Plug off all vents/drains when not actually being used.
2. Ensure fire/drench water for dilution quantity is adequate for Alkylation areas to cope with re-leases.
3. Review/retrain operators on pump start-up procedures.

5847 09 November 1992

Source : OIL AND GAS JOURNAL, 1993, 8 MAR.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, JAN.; LLOYDS LIST, 1992, 10 &16 NOV.; THE INDEPENDENT, 1992, 10 NOV.

Location : Marseilles, FRANCE

Injured : 12 **Dead** : 6

Abstract

Explosion in catalytic cracker in refinery. There was a subsequent fire in a gasoline tank and cryogenic unit involving propane and butane. Cause believed to be due to the rupture of a pipe carrying LPG to a low pressure gas scrubber. The inquiry concluded that 10 tonnes escaped and exploded after leak from pipework in one of the gas plant towers recovering liquified gas produced by the upstream catalytic cracker. The leak was probably caused by corrosion. Fatality.

[refining, cracking]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 7 Dead : 0

Abstract

On the 8th November, 1991, a contractor's pipefitter removed a 3/4" plug from the outlet of a coalescer in order to replace a thermal relief valve. Isobutane was released and the subsequent vapour cloud ignited by a welder working on the repair of a pipe at a point some 20 feet away.

The isobutane coalescer pressure was approximately 40 psig at the time.

Seven contractor employees were injured in the incident, two were admitted to hospital with serious burns.

[fire - consequence, vapour cloud explosion, management system inadequate, injury]

Lessons

1. Verbal instructions can be misunderstood or incorrectly communicated. A work permit system provides the means to formally authorize modifications, maintenance, repairs, or other work of a similar nature which necessitates some departure from the normal operation/production activities, so that such work can be carried out in a safe, controlled manner.
 2. All maintenance personnel should formally check-in with the operator/control room before entering and leaving a unit. This ensures the safety of Maintenance personnel and reduces the possibilities of unauthorized work on the unit.
 3. Many accidents have occurred because the results of plant modifications were not foreseen.
 4. When a unit/plant is shut down for maintenance, it does not necessarily mean that all equipment is "dead" and gas/liquid free. Maintenance personnel/contractors should always presume that the equipment is unsafe to work on, unless satisfied through a work permit and lockout/tagout arrangement before proceeding further. Contractors should be encouraged to question Operations staff about all aspects of the job, especially those related to safety.
 5. Good communication between all those involved in a major incident is vital.
 6. At times sections of a refinery's firewater network have to be taken out of service for repair and maintenance. It is essential that "out-of-use" parts of a system - e.g., hydrants - are identified and marked and that such information is available at the Incident Control Center.
-

Source : ICHEME

Location : , USA

Injured : - Dead : 0

Abstract

A fire occurred on an LPG loading rack. The incident occurred when an LPG loading hose pulled free of the railcar liquid fill valve shortly after loading had commenced. The LPG was 70% propylene, 30% propane, loading at more than 350 gpm at 300 psi.. Two cars were being loaded simultaneously. There was a spill, and ignition occurred. As the fire dwindled, was taken not to extinguish the flame, to avoid forming another vapour cloud that could possibly re-ignite. The entire loading system contents including the piping and the two railcars was allowed to depressure and burn out, this took about 30 minutes.

Damage was confined to one loading rack and an LPG road tanker adjacent to the fire area. Physical injuries were minor.

[vapour cloud explosion, spark, fire - consequence, damage to equipment, rail transpor, gas / vapour release, injury]

Lessons

[None Reported]

Source : LLOYDS LIST, 1992, 7 NOV.

Location : Massey Creek; Scarborough; Ontario, CANADA

Injured : 0 **Dead** : 0

Abstract

A rail transportation incident. Thousand of gallons of lubricating oil spilled and contaminated water after a rail tanker car had a valve opened.
[ecological damage]

Lessons

[None Reported]

5833 25 October 1992

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1992, DEC.

Location : , DUTCH COAST

Injured : 0 Dead : 0

Abstract

A marine transportation incident. Vessel with 2352 tonnes of lead concentrates sank in heavy seas. Salvage planned.
[weather effects, sinking]

Lessons

[None Reported]

5815 08 October 1992

Source : THE CHEMICAL ENGINEER, 1992, 15 OCT.; LLOYDS LIST, 1992, 10,12, & 13 OCT., & 15 DEC.

Location : Wilmington; California, USA

Injured : 16 Dead : 0

Abstract

Massive explosion in refinery hydrogen processing unit was fuelled by light gases and gasoline. The fire was visible from 32 km away. People in a 5 sq km area were evacuated. Automatic shutdown valves failed to operate. Later reports indicated that the cause was corrosion of a pipe which was one eighth instead of five-eighths of an inch.

[evacuation, valve failure, refining, fire - consequence]

Lessons

[None Reported]

5757 25 August 1992

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1992, OCT.

Location : Agen, FRANCE

Injured : 0 Dead : 0

Abstract

A road transportation incident. A road tanker was hit from behind at traffic lights by a heavy goods vehicle causing leak of LPG from pipes. 100 evacuated.
[collision, gas / vapour release, evacuation, spill]

Lessons

[None Reported]

5746 15 August 1992

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1992, OCT.

Location : Madras, INDIA

Injured : 0 Dead : 0

Abstract

During overnight material transfer a spill of 1060 tonnes of kerosene occurred into a harbour through a valve failure on a receiving marine tanker.

Lessons

[None Reported]

5707 09 July 1992

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 3RD QUARTER, 1992.

Location : Baytown; Texas, USA

Injured : 0 **Dead** : 0

Abstract

A fire broke out on an offsite pump. Substance involved: isobutylene.

[fire - consequence]

Lessons

[None Reported]

5701 02 July 1992

Source : LLOYDS LIST, 1992, 22 JUL.

Location : El Segundo; California, USA

Injured : 0 **Dead** : 0

Abstract

Fire broke out in the furnace of the jet fuel processing plant.

[fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A catalyst charge vessel was being prepared for entry to repair a hole. The vessel was washed twice and then the manhole cover was removed. On opening a flange to fit a blank there was a deflagration in the vessel. On investigation it was found that the flammable mixture came from the reactor where the washings were drained and a common vent system. Substances involved: ketone and hydrogen
[fire - consequence, design or procedure error, reactors and reaction equipment]

Lessons

[None Reported]

5625 07 April 1992

Source : LLOYDS LIST, 1992, 8 APR., & 9 APR.; FIRE PREVENTION, 1992, OCT.; OIL & GAS JOURNAL, 1993, 4 OCT., 40-44.; WASHINGTON POST, 1993, 30 SEP.

Location : Brenham; Texas, USA

Injured : 23 **Dead** : 3

Abstract

An LPG vapour cloud explosion near LPG salt storage cavern also involved nearby gas pipelines. Explosion measured 4.5 on the Richter scale and was felt 90 miles away. Cause originally thought to be pipeline failure. Now investigations indicate that the cavern was overfilled from the 8 inch pipeline causing the brine level to be forced below the water injection pipe. The LPG migrated up this pipe and into the brine storage pit where it escaped to atmosphere. Ignition of the vapour cloud was possibly by a vehicle. Fatality.

[salt dome storage, overflow]

Lessons

[None Reported]

5606 20 March 1992

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1992, MAY.

Location : Near Sarnia; Ontario, CANADA

Injured : 0 **Dead** : 0

Abstract

Double isobutylene spill from plant to river. 1500 kg spill on the first day and a 245 kg spill on the second.

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1992, MAY.

Location : Kwangiu, SOUTH KOREA

Injured : 0 Dead : 0

Abstract

A road transportation incident. Explosion and huge fire occurred after brake failure caused truck unloading LPG to reverse into storage tank. 3 gas storage tanks ablaze. Led to the evacuation of 20,000 people.

[road transport, brakes faulty, fire - consequence]

Lessons

[None Reported]

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 1ST QUARTER, 1992.

Location : Windsor; Ontario, CANADA

Injured : 0 **Dead** : 0

Abstract

A fire resulted from a rupture of an LPG pipeline from underground storage to dehydrating unit.

[fire - consequence]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, 1992, MAR., 82.

Location : Petersfield; Hampshire, UK

Injured : 0 **Dead** : 0

Abstract

A road transportation incident. A road tanker carrying 9000 litres of kerosene and 3000 litres of heating oil overturned in freezing fog conditions. 100 litres of kerosene entered drains.

[spill, cold weather]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A rail transportation incident. An LPG loading hose pulled free of a rail tanker liquid fill valve shortly after loading commenced. The resulting spill ignited. When loading began the connection began to leak, and when an operator tried to close up the leaky connection, the coupling gave way and blew out. Examination of the steel coupling revealed flattened and damaged threads. In addition the operator had only been with the company for 6 months and had no previous operating experience and did not follow guidelines for loading LPG railcars.
[operator error]

Lessons

Perform regular inspection of hoses, couplings, bonding systems, etc. Adequate provision should be available for safe shut down of LPG systems without presenting hazards to personnel.

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, MAY.; LLOYDS LIST, 1992, 22 FEB.

Location : Off New Jersey, USA

Injured : 0 Dead : 0

Abstract

A marine transportation incident. 441 drums of arsenic trioxide lost from vessel deck when 21 containers were lost during storm. 600 lbs of magnesium phosphide spilled in the ship's hold.

[weather effects]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 109, 7-10.

Location : ,

Injured : 0 Dead : 0

Abstract

A centrifuge feed tank, of 30 m³ capacity, manufactured of rubber lined carbon steel and containing an aqueous slurry of iminobaisacetonitrile (IBA), ruptured due to overpressurisation caused by decomposition reactions during a cleaning operation. Although personnel injuries were minor, there was extensive damage to plant facilities. The cost of plant rebuilding and the business interruption loss amounted to the equivalent of well over £10 million (1992).

On the day of the incident a large build-up of solids was noticed on the internal coil and in the tank headspace, and level instrumentation problems were experienced. Further investigation revealed that the tank vent was blocked and causing the level transmission errors by allowing a vacuum in the tank. Realising that tank clean out was necessary, operational staff stopped transfers into the tank and continued feeding forward to the centrifuge via a side outlet. When the level dropped to this outlet, an attempt to empty the heel of slurry to the centrifuge through the tank bottom was made, but the connection was blocked. The blockage was cleared but the heel was not emptied.

The tank was then filled with process water until the level reached the upper tangent line of the top head, as observed through a sightglass. At 1615 hours circulation was started and steam was turned on to the coil, with the objective of heating the contents to 70 degrees C and then allowing circulation of the hot water for a further 30 minutes. Soon after the steam flow was started the level indicator reading returned to normal, suggesting that the tank vent was at least partially open.

At 1640 hours the tank contents reached 40 degrees C, the upper limit of the installed temperature indicator. Subsequently, temperature measurements were made using a portable surface-reading pyrometer on the circulation pump suction piping. At 1740 the temperature was 55 degrees C and at 1835 it had reached 74 degrees C. Steam was then shut-off from the coil, the circulation was stopped, and an operator tried to empty the tank contents via a gravity drain line.

Draining was unsuccessful due to a blockage in the pipe, a flexible hose to a drain valve on the discharge of the pump. At 1910 hours draining was started via the hose to a floor drain. The operator looked through the tank sightglass to confirm that the level had started to decrease before returning to the control room. At about 1920 hours two field operators responded to what sounded like a high pressure steam leak in the feed tank area of the plant. Almost immediately they came within view of the tank, at a distance of about 12 metres, it violently ruptured. They were blown backwards and sprayed with a black residue, but returned to the control room unaided and sustained only minor injuries.

The tank overpressurisation was caused by the steam pressure that was generated by the heat of chemical reactions. Initially the IBA started to decompose due to overheating during the cleaning operation. The hydrogen cyanide (HCN) formed then polymerised, significantly augmenting the heat evolution, and provided the heat essential for vessel rupture.

The chemical reactions were initiated by the use of a tank cleaning operation which was unsuitable for the process material, particularly in respect of heating medium, water quality and procedure.

[vent blocked, solids deposition]

Lessons

As a result of the investigation a series of preventative recommendations were made:

1. Reduction in IBA build-up.

Consider the impact of upstream equipment performance and operations on solids build-up in the feed tank.

Consider the installation of nozzle inserts in the feed tank entry and re-circulation piping to minimise splashing and run-down on the head.

Consider operating the feed tank through the bottom outlet only and decide on the need for a side outlet.

2. Reduction in IBA quantity at clean out.

Establish clear guidance on the planning and minimum frequency of feed tank clean outs.

Ensure that cleaning is carried out before the build-up is too large, and only after the feed tank is fully drained.

3. Reduction in temperature to safe level below IBA decomposition.

Ensure that steam is not used for cleaning the feed tank and for unblocking/decontaminating associated piping. Remove steam connections to the coil.

Develop a safe temperature controlled method for cleaning the feed tank and associated piping, provide the necessary facilities to support the method, and establish formal instructions for clean out.

Ensure that steam is not used for cleaning all other vessels where IBA is present and for unblocking/decontaminating associated piping. Provide for temperature controlled cleaning as above. Where steam heating is employed as part of normal operation, evaluate the use of tempered water or gain formal approval of continued use of steam.

4. Reduction in IBA exposure time to heat.

Provide for specified time limits as part of new cleaning procedures.

5. Prevention of contact with alkaline solutions.

Connect only non-basic pH controlled water to the feed tank.

Connect only non-basic pH controlled water to other vessels containing IBA and/or HCN .

6. Improvement in process instrumentation.

Provide an improved temperature measuring system on the feed tank to reliably monitor both normal and clean out temperature ranges.

Provide a high temperature alarm, high temperature interlock, and high rate of temperature rise interlock on the feedtank. Either interlock should discontinue cleaning operations and initiate corrective actions.

Provide a high temperature alarm, high temperature interlock, and high rate of temperature rise interlock on other vessels containing IBA and/or HCN. Either interlock to be discontinue normal operations and cleaning operations, and initiate corrective actions.

Provide an improved level measuring system on the feed tank to operate reliably independently of vessel pressure.

7. Improvement facilities in emergency.

Consider the provision of quench systems to terminate a reaction if started in the feed tank and other vessels containing IBA. Ensure that the feed tank and other vessels containing IBA are provided with vent systems of adequate size which can be monitored and maintained operational.

8. Improvement in process knowledge and documentation.

Ensure that all process documentation is updated to effectively emphasise the reactivity and thermal stability characteristics of IBA. Establish a procedure to review, incorporate and communicate changes or new information impacting process safety at least annually. Educate all personnel on the hazards of IBA reactivity, particularly in respect to the revised operating and cleaning procedures introduced.

9. Additional hazard assessment.

Conduct HAZOP studies on designated IBA/HCN containing vessels throughout the manufacturing process.

Source : CHEMICAL HAZARDS IN INDUSTRY, 1993, JUN.

Location : , GERMANY

Injured : 0 **Dead :** 0

Abstract

Hydrogen enrichment of the gaseous phase in a rail tanker initiated an exothermic reaction between hydrogen and chlorine which in turn triggered fire of iron chloride.

[fire - consequence]

Lessons

[None Reported]

Source : LLOYDS LIST, 1992, 2 JAN.

Location : Mount Isa; Queensland, AUSTRALIA

Injured : 0 **Dead** : 0

Abstract

Steam explosion occurred at a lead plant when molten slag was discharged from a smelting furnace after a refractory failure and mixed with water in spillage pits.

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1991, OCT.

Location : Hume Highway; Wandong; Melbourne, AUSTRALIA

Injured : 0 **Dead** : 0

Abstract

A road transportation incident. A road tanker of LPG was shunted from behind and ignited. Traffic stopped and tanker later exploded.
[explosion]

Lessons

[None Reported]

5391 26 July 1991

Source : WASHINGTON POST, 1991, 24 JUL.

Location : Lorton; Fairfax County; Maryland, USA

Injured : 0 **Dead** : 0

Abstract

A road transportation incident. A road vehicle carrying toxic chemicals caught fire. An aluminium powder waste from a tear gas factory ignited spontaneously.

Other substance involved: methylene chloride and lindane

[autoignition, fire - consequence]

Lessons

[None Reported]

10276July 1991

Source : CNN NEWS MEDIA VAULT, 19 JULY, 1991,; 1996 CABLE NEWS NETWORK, INC, (<http://www.cnn.com>).

Location : , USA

Injured : 0 Dead : 0

Abstract

A chemical spill involving the herbicide insecticide metumsodium occurred. Test levels showed concentrations of metumsodium 300 times the level that kills fish and twenty times higher than the level allowed in drinking water. An estimated 300 thousand fish were killed as the chemical effectively sterilised a 40 mile stretch of the river.

[ecological damage]

Lessons

[None Reported]

Source : LLOYDS LIST, 1991, 1 JUL.

Location : Bombay, INDIA

Injured : 0 **Dead** : 0

Abstract

An explosion followed by fire on lube oil base stock. Within 15 minutes there were three more explosions. Report of fire in de-waxing unit spreading to propane tank.

[fire - consequence]

Lessons

[None Reported]

5330 16 May 1991

Source : BBC NEWS

Location : Cobham; Surrey, UK

Injured : 0 Dead : 0

Abstract

Transportation. A spill of jet fuel occurred from a pipeline.

Lessons

[None Reported]

5311 03 May 1991

Source : LLOYDS LIST, 1991, 6 MAY.

Location : Cordoba, MEXICO

Injured : 300 **Dead** : 0

Abstract

An explosion occurred at an insecticide plant caused many casualties and the evacuation of 1500 people. Contamination of drinking water. Suspected cause was a short circuit.

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1991, JUN.

Location : Basford; Nottinghamshire, UK

Injured : 4 **Dead** : 0

Abstract

An explosion and fire occurred at an LPG bottling plant.

[fire - consequence]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1991, OCT.

Location : Toronto, CANADA

Injured : 0 **Dead** : 0

Abstract

A road transportation incident. 2 safety relief valves sheared off on LPG road tanker when passing through an underpass. Jet of propane 3 m high. 2 000 people evacuated. Electricity isolated, trains stopped. LPG successfully transferred to another tanker.
[evacuation]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1991, OCT.

Location : Wangdon; Melbourne, AUSTRALIA

Injured : 0 **Dead** : 0

Abstract

A road transportation incident. Recent LPG road tanker incident in Australia.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : -

Abstract

HF (hydrogen fluoride) Alkylation Incident. While maintenance was being performed to replace a seal on an acid circulation pump, the pump casing flange blew apart, releasing hydrogen fluoride acid and isobutane. A block valve on the system did not function as intended, and a key pressure gauge on the pump discharge line was not used. In addition maintenance work had begun before safe work permits had been issued. Incorrect assumptions were made about the readiness of the system, rather than checking/waiting for work permits.

[safety procedures inadequate, fatality]

Lessons

There is no substitute for the development, documentation, training and implementation of proper procedures at all levels.

Although design and proper operation are the most effective tools in preventing process related incidents, an experienced, well-equipped emergency response team is invaluable in mitigating the consequences of such incidents, including the proper management of government agencies.

5263 22 February 1991

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1991, APR.; BBC NEWS

Location : Stansted; Essex, UK

Injured : 0 Dead : 0

Abstract

Transportation. A spill of jet fuel from a pipeline in a river formed a 10 km oil slick.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A leak occurred from a pipeline at a refinery crude distillation plant and led to a fire. Substances involved, diesel and kerosene.

[fire - consequence]

Lessons

[None Reported]

5189 11 December 1990

Source : LLOYDS LIST, 1990, 12 DEC.

Location : Milford Haven; Dyfed, UK

Injured : 1 **Dead** : 0

Abstract

Faulty valve on alkylation unit released isobutane causing two explosions.

[valve failure]

Lessons

[None Reported]

Source : LLOYDS LIST, 1990, 5 DEC., & 1991, 3 JAN.**Location :** Denver; Colorado, USA**Injured :** 0 **Dead :** 0**Abstract**

A fire that burned for 55 hours at the fuel storage area for an airport destroyed or damaged 7 tanks and consumed more than 1.66 million gallons of jet fuel.

The fourth largest large-loss fire of 1990, it caused \$30 million (1990) in damage. There were no reported injuries from the fire.

On Sunday morning, November 25, 1990, one of the fuel supply companies began pumping fuel to CAL Tank 7. The company's facilities were 5 miles away, and at a 100' elevation above the airport tank farm. Fuel to the CAL tank flowed through pipes adjacent to the UAL tanks.

Fuel was also being transferred from the UAL tanks to the airport. There were no personnel at the tank farm during these operations.

At about 09.20 hours the fuel supply company received a 'no flow' indication in the pipeline.

About 5 minutes later, the pumps restarted, but only pumped about 4 barrels of fuel before the 'no flow' indication recurred; and the company stopped operations at this time.

Personnel in the airport control tower spotted a column of black smoke and notified the airport fire department. At 09.22 hours, four aircraft rescue and fire fighting (ARFF) trucks and one rapid intervention vehicle were dispatched to the tank farm. This was quickly followed by pumpers, trucks, and a build-up of senior fire officers and fire crews.

The ARFF crews arrived within 4 minutes of dispatch and found a large pool fire in the valve pit. Two distinct streams of flaming fuel forming a "V" shape extending 25-30' into the air.

Investigators believe that the initial fuel involved an operating pump and that the ignition source may have been the same pump. Preliminary findings indicate that fuel from a second source - a cracked pipe flowing fuel to a CAL tank - was feeding the fire before fire fighters arrived.

[valve failure, fire - consequence, no flow, aviation fuel]

Lessons

1. Fire fighters were unable to stop the backflow of fuel from the flight line to this valve because there was no manual shut-off near the valve.
2. Fire department personnel attempted a dual agent attack on tank pipework fires, but were unsuccessful as they were unable to sustain AFFF streams for more than or 5 minutes.
3. Past Lessons not applied to Engineering Standards: A friction coupling opened releasing fuel from the tank. It is known that this type of coupling will not hold up under intense flame conditions.
4. Radiant heat on the shell or roof will create vapours which will accumulate under the roof and when pressure increases, flammable vapours will result.
5. In order to detect equipment deficiencies, it must be inspected regularly according to specified procedures.
6. There was insufficient knowledge on how to stop the flow of fuel.
7. Inadequate Training: Responding firefighting crews were not trained in handling 3-dimensional flammable liquid fires requiring unique suppression tactics and equipment.

Source : LOSS PREVENTION BULLETIN, 129, 12; LENOIR E.M & DAVENPORT J.A, A SURVEY OF VAPOUR CLOUD EXPLOSIONS SECOND UPDATE, PROCESS SAFETY PROGRESS, 1993, 12, (1), 12-33.; LLOYDS LIST, 1990, 8 NOV., & 19 NOV.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1991, JAN.; THE TIMES OF INDIA, 1990, 7 NOV.

Location : Nagothane; Bombay, INDIA

Injured : 20 **Dead** : 21

Abstract

A leak in a LPG pipeline that transports ethane and propane to a gas cracker complex resulted in an explosion at an off-site treatment compression facility. Since the explosion took place outside the complex, the cracker and downstream units were not damaged while the off-site facility experienced significant damage. The cracker was initially shut down due to feedstock supply problems but was later operating on a gas supply directly from the pipeline.

Prior to this incident, low density polyethylene (LDPE), linear low density polyethylene (LLDPE), high density polyethylene (HDPE), and polypropylene (PP) units were to be brought on-line within a few months. The commissioning of these units was expected to be delayed between four and 12 months due to this incident. Fatality.

Lessons

[None Reported]

5155 28 October 1990

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1991, JAN.

Location : Isle Of Grain; Kent, UK

Injured : 0 Dead : 0

Abstract

A rail transportation incident. Derailment of 17 of 20 rail tanker wagons caused 200 tonnes of jet fuel to be spilled into an estuary.

Lessons

[None Reported]

5154 27 October 1990

Source : LLOYDS LIST, 1990, 31 OCT.

Location : Pajaritos, MEXICO

Injured : 3 Dead : 1

Abstract

Explosion in vessel's after part occurred when loading LPG into a marine gas carrier. Fatality.
[marine transport]

Lessons

[None Reported]

5153 26 October 1990

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1991, JAN.

Location : Marlborough, New York, USA

Injured : 0 **Dead** : 0

Abstract

A marine transportation incident. A marine tanker barge ran aground causing a spill of 490 tonnes of kerosene into a river.

[ship ran aground]

Lessons

[None Reported]

5149 20 October 1990

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1990, DEC.

Location : , SOUTH PACIFIC

Injured : 0 Dead : 0

Abstract

A marine transportation incident. An explosion of an LPG cylinder forward on a cargo ship led to a fire that spread over drummed fuel cargo. Ship was abandoned and sank with large oil slick.

[sinking, fire - consequence, pollution]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN 101, 19-21; LLOYDS LIST, 1990, 2 OCT.

Location : Bangkok, THAILAND

Injured : 100 **Dead** : 68

Abstract

A road transportation incident. A road tanker carrying 5 tonnes of LPG was involved in a collision at a busy road junction and resulted in a flash fire involving many vehicles. The road tanker was not licensed to carry LPG and had two pressure vessels on a flatbed lorry. The vehicle overturned and the vessels broke away from the lorry. The two interconnecting lines are believed to have sheared to release the LPG. Fatality.

[fire - consequence]

Lessons

[None Reported]

5105 29 August 1990

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1990, DEC.

Location : Jacksonville; Florida, USA

Injured : 0 **Dead** : 0

Abstract

A marine transportation incident. Ship struck dock and punctured four 200 mm fuel lines causing a spill of 50,000 litres of gasoline and jet fuel into river.

Lessons

[None Reported]

5084 07 August 1990

Source : MARYLAND GAZETTE, 1990, 8 AUG.

Location : Baltimore Washington International Airport, USA

Injured : 0 **Dead** : 0

Abstract

1,200 gallons of jet fuel overflowed a storage tank due to defective bleed valve. Spill.

[storage tanks]

Lessons

[None Reported]

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 3RD QUARTER, 1990.

Location : Benicia; California, USA

Injured : 0 **Dead** : 0

Abstract

A fire led to shutdown of a catalytic cracker. Substance involved: lube oil.

[fire - consequence, cracking]

Lessons

[None Reported]

4997 28 May 1990

Source : LLOYDS LIST, 1990, 21 JUL.

Location : Fairbanks; Alaska, USA

Injured : 0 **Dead** : 0

Abstract

A rail transportation incident. Derailment of rail tankers caused a spill of 100 000 gallons of fuel oil/jet oil.

Lessons

[None Reported]

4965 22 April 1990

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1990, AUG.

Location : Muskegon; Michigan, USA

Injured : 46 **Dead** : 0

Abstract

Malfunction at factory caused phosphorus oxychloride to contact with limestone. A toxic cloud formed leading to the evacuation of 1 000 people.
[contamination, gas / vapour release]

Lessons

[None Reported]

Source : ICHEME**Location :** , UK**Injured :** 0 **Dead :** 0**Abstract**

600 kilogrammes of isobutane was released from a reaction loop when a joint failed in a sight glass assembly. At the same time, dumping of the reactor loop was in progress as reaction had been lost and the recycle diluent pumps had failed. A significant amount of water contamination was found in the recycle diluent and reactor systems; the sources were the flash gas recycle compressor and the compressor recycle cooler. The leak in the compressor resulted from a failed pressure tapping which was not used by process and was included by the manufacturer only for pre-commissioning checks. The subsequent leak from the cooler was caused by the cooling water supply being isolated and the compressor being shut down. Under these conditions, condensation of isobutane in the discharge pipework followed by flashing across a control valve created a very low process temperature, which led to icing in the exchanger. This caused the tube failure and water ingress. The immediate cause of the release was the failure of a gasket in the sight glass assembly. The gasket was found to be incorrectly seated following an earlier leak and repair. The cause of both leaks was interference between the gauge cover flange and the clamping bolts. There was no common factor linking the water ingress to the failure of the sight glass.

[shutdown, gasket, gas / vapour release, gasket failure]

Lessons

1. Communicate the hazards associated with shutting down a recycle gas compressor, and the possibility of exchanger tube failure due to 'ice damage'.
2. Revise shut down procedures.
3. Check functionality of relevant alarm and trip devices.
4. Examine commissioning tappings on similar compressors.
5. Inspect similar sight glasses for signs of potential failure.
6. Consider alternative level gauges.
7. Develop an instruction highlighting the 'do's and don't's' of level gauge maintenance, and train relevant personnel.
8. Consider routine inspection and retorquing of this type of gauge.
9. Review range and quality of spares and suppliers.
10. Ensure an acceptable level of resources and experience in pre-commissioning/ commissioning teams for future projects.

4959 10 April 1990

Source : THE WASHINGTON TIMES, 1990, 11 APR.

Location : Glendale; Wisconsin, USA

Injured : 0 **Dead :** 0

Abstract

A fire occurred at a plant which started near some cardboard boxes and spread to storage tanks of oil, kerosene and pesticides.

[fire - consequence]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 129, 8.

Location : ,

Injured : 0 Dead : 0

Abstract

An operator was draining water from the debutanizer system of the fluid catalytic cracking (FCC) gas plant when liquefied petroleum gas (LPG) was suddenly released. The LPG release continued at this 65,000 barrels-per-day refinery as the operator panicked and left the FCC gas plant. Subsequently, an ignition occurred resulting in an explosion and fire.

[catalytic cracker, refining, fire - consequence, fluid cracker]

Lessons

[None Reported]

4953 01 April 1990

Source : DAILY TELEGRAPH SYDNEY, 1990, 3 APR.; SYDNEY MORNING HERALD, 1990, 2 APR.

Location : Sydney, AUSTRALIA

Injured : 0 **Dead :** 0

Abstract

An explosion and fire devastated a 4 storage tank plant, resulting in the evacuation of 50,000 residents and closure of the airport. A 40 000 litre tank was hurled 300 metres into a river. A safety relief valve failure on 40 000 gallon LPG bullet tank released gas which ignited. Fire engulfed four 100 tonne LPG tanks and one 45 tonne tank.

[fire - consequence, storage tanks]

Lessons

[None Reported]

4925 14 March 1990

Source : LLOYDS WEEKLY CASUALTY REPORT; LLOYDS LIST, 1990, 15 MAR.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1990, JUN.; OIL AND GAS JOURNAL, 1991, 24 JUN.

Location : Albany; North Blenheim; New York, USA

Injured : 5 **Dead** : 2

Abstract

Transportation. Leaking LPG pipeline suffered an explosion and flattened part of a small town. Explosion from 8 inch line roared through town at 0730 hours. Huge vapour cloud 1000 ft high. Underground line is part of nationwide distribution. Blast was result of undetected leak along a 4100 mile pipeline. The pipeline was built in the 1960s and did not have automatic shut off valves. Fatality.

[gas / vapour release]

Lessons

[None Reported]

4897 20 February 1990

Source : SYDNEY DAILY TELEGRAPH, 1990, 3 APR.

Location : Port Kembla, AUSTRALIA

Injured : 14 **Dead** : 0

Abstract

LPG gas leaked from oven and collected underneath before ignition.

[fire - consequence]

Lessons

[None Reported]

4877 01 February 1990

Source : WORLD LOSS REPORT, 1990, 23 FEB.

Location : Punta Cardon, VENEZUELA

Injured : 0 Dead : 0

Abstract

Leak on hydrofluoric acid recovery column ignited and burned out fin fan coolers. Fire burned for 55 hours because of difficulties in isolating an isobutane accumulator and flare system. Also stated that safety relief valve lifted and ignited. Note that world loss report gives date as 31/1/90.
[fire - consequence]

Lessons

[None Reported]

Source : LLOYDS LIST, 1990, 26 MAR.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1990, MAY.

Location : Avon Lake; Ohio, USA

Injured : 1 **Dead** : 2

Abstract

Explosion in chemical mixing building causing toxic emission alarm to be actuated. Explosion caused by a metal-to-metal spark while unblocking magnesium granules in a blending machine ignited the magnesium. Company procedure called for the use of a wooden rod. Fatality.
[operation inadequate]

Lessons

[None Reported]

Source : CONCAWE REPORT 4/91

Location : , WESTERN EUROPE

Injured : 0 **Dead :** 0

Abstract

Transportation. A 225 cubic metres gross spillage of light oil occurred in a rural area when a bulldozer engaged in road construction punctured a pipeline. The pipeline operator was unaware of the work proceeding in the pipeline's vicinity. The pipeline is permanently marked at 500 m intervals and two of the markers were visible to the bulldozer operator. Following a temporary repair, the pipeline was put back into service 12 hours later. The spillage was of light product onto porous ground, and caused no ongoing ground pollution.

[damage by bulldozer, bulldozer/JCB/digger]

Lessons

[None Reported]

Source : CONCAWE REPORT 4/91

Location : , WESTERN EUROPE

Injured : 0 **Dead :** 0

Abstract

Transportation. The accidental closure by a pipeline workman of a main line valve at a pump station caused a scraper-pig trap at an upstream facility to be over-pressurized. A spillage of 252 cubic metres gross of jet fuel occurred. The pipeline was out of service for two days while the trap installation was modified. There was no significant pollution.

[overpressurisation, operator error]

Lessons

[None Reported]

Source : ICHEME

Location : , PERU

Injured : 1 Dead : 0

Abstract

A transportation incident. A coker plant trackmobile was locating coke cars under a coke drum, when it was noticed that there was a low lube oil light indicating on the trackmobile engine.

The engine was shutoff, and it was found that a lube oil hose had broken and was leaking oil.

The position of the trackmobile at this time was still coupled to the coke cars which were to be positioned under the coker drum.

The switchcrew of a locomotive working on an adjacent railtrack were asked by the coker crew for assistance. So the locomotive changed tracks and coupled up to the trackmobile, hooking up the air brake hoses, and then proceeded to push the trackmobile and coke cars under the coker drum, to locate the first coke car.

After completing this operation, the coke cars were uncoupled, and the locomotive proceeded to pull the trackmobile to the workshops, for repair.

One switchman guarded the crossing while the locomotive and trackmobile crossed, and he then jumped onto the south facing end of the locomotive, and was riding in this position when the accident occurred.

The second switchman rode on the south-west platform of the trackmobile. The locomotive driver was watching southwards, to see what signals his switchman would give him, pulling the trackmobile, when he felt a bump. Looking towards the trackmobile he saw that the latter had jumped off the railtracks and was uncoupled from his locomotive, and was moving towards a railcar standing on Track No. 19.

The trackmobile hit the railcar, with the switchman still riding on its platform. Fortunately however, he managed to fall off the trackmobile and under the standing railcar, avoiding being crushed between the two.

He was lying under the railcar, apparently suffering from shock, and was told to lay still until help could be obtained. The refinery rescue squad arrived in 10 minutes, and the switchman was taken to hospital. The Safety Dept. and Doctor were informed, to follow the man's condition.

Maintenance Dept. personnel removed the trackmobile from the accident position (with cranes) for subsequent repairs, which were limited to handrails and ladder damage. The railcar sustained ladder damage, its safety protection rail torn off, and the skin of the car was creased, however the car was pronounced fit to load.

Investigations:

1. Its engine oil was found to be low, requiring a gallon of oil to top up, as the drain hose off the bottom of the air compressor had slipped off the drain pipe causing a leak.

2. The hydraulic oil level was satisfactory.

3. With the engine running, the rail wheel pressure was 500 psi on the front and 550 on the rear. The manufacturer's book calls for 525 to 575 psi.

The incident was caused by not having the trackmobile engine running (ie. when it was being towed by the locomotive on the track), hydraulic oil pressure on its steer wheels was lost, and the entire weight of the trackmobile was put on its rubber road wheels, without having the steer wheels to guide it on the railtrack. This caused the trackmobile to be de-railed from the track, veering off and striking the stationary railcar on an adjacent track.

[loading]

Lessons

1. Check calibration of hydraulic oil pressure gauge on trackmobile.

2. Some level checking at pertinent rail crossings.

3. Install a sign on the trackmobile stating, "Do no move with engine off".

4. Retrain selected operators and transportation personnel in trackmobile operation.

5. Install clamped longer hoses to replace broken hose.

6. Check with manufacturer the feasibility of installing pneumatic alarms.

7. Have a follow up safety meeting with a manufacturers representative.

8. Writing up a 'towing procedure' (to be provided by the manufacture) and incorporated in manual; and

9. To install a replacement engine for the trackmobile.

4782 28 November 1989

Source : HULL DAILY MAIL, 1989, 28 NOV.

Location : Hull, UK

Injured : 0 Dead : 0

Abstract

A violet cloud of iodine gas was released when methyl iodide vented into the flare stack.

[gas / vapour release]

Lessons

[None Reported]

4766 03 November 1989

Source : SYDNEY DAILY TELEGRAPH, 1990, 3 APR.

Location : Kurnell, AUSTRALIA

Injured : 2 Dead : 0

Abstract

A fire occurred in a refinery. Substance involved: LPG.

[fire - consequence, refining]

Lessons

[None Reported]

4762 31 October 1989

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1990, MAR.

Location : Off Shikoku, JAPAN

Injured : 0 **Dead** : 9

Abstract

A marine transportation incident. A marine chemical tanker hull ruptured after a collision and split in two and sank. Spill of isopropyl alcohol. Fatality.
[sinking]

Lessons

[None Reported]

Source : LEES F.P, LOSS PREVENTION IN THE PROCESS INDUSTRIES, VOL3, 2ND ED., BUTTERWORT HEINEMANN, 1996, ISBN,0750615478.; OSHA, US DEPT OF LABOR REPORT TO THE PRESIDENT APRIL 1990; LOSS PREVENTION BULLETIN, 099; LLOYDS LIST, 1989, 25 OCT.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1990, MAR.

Location : Pasadena; Houston; Texas, USA

Injured : 100+ **Dead** : 23

Abstract

A massive and devastating vapour cloud explosion occurred in this polyethylene plant causing loss of life and extensive damage to plant with a force of 2.4 tonnes TNT. The accident resulted from a release of process gas during maintenance on a blocked reaction loop line. The instrument line to a shut valve was being connected when the valve opened and the massive release occurred. The valve actuating hoses were found connected the wrong way round.

Substances involved: isobutane, hexane, ethylene and hydrogen. Fatality.

[gas / vapour release, reaction vessel, maintenance inadequate, fire - consequence, isolation inadequate]

Lessons

The OSHA report details numerous defects in the management of the installation. Some of these are described below.

1. The company had made no use of hazard analysis or an equivalent method to identify and assess the hazards of the installation.
 2. Separation distances between process equipment plant did not accord with accepted engineering practice and did not allow time for personnel to leave the plant safely during the initial vapour release and that the separation distance between the control room and the reactors was insufficient to allow emergency shut down procedures to be carried out.
 3. The ventilation intakes of buildings close to or downwind of the hydrocarbon processing plants were not arranged so as to prevent intake of gas in the event of a release.
 4. There was a failure to minimize the exposure of personnel.
 5. The plant had no fixed flammable gas detection system despite the fact that the plant had a large inventory of flammable materials held at high pressure and temperature.
 6. An effective permit system was not enforced for the control of the maintenance activities.
 7. The sole isolation was a ball valve which was meant to be closed but was in fact open. There was no double block system or blind flange. The practice of not providing positive isolation was a local one and violated corporate procedures.
 8. The practice of relying for fire water on the process water system and the failure to provide a dedicated fire water system meant that the fire water system was vulnerable to an explosion.
-

Source : LOSS PREVENTION BULLETIN, 129, 12-13.

Location : ,

Injured : 0 Dead : 0

Abstract

A large flow of ethylene, the reactant, and isobutane, a catalyst carrier, was released from one of the high density polyethylene (HDPE) units at this chemical complex. The vapour cloud drifted northward toward the centre of the HDPE process area before ignition, which is believed to have occurred approximately one minute after the release. Seismograph data from recording stations in the area suggested the blast was equivalent to the detonation of 10 tonnes of TNT. The explosion destroyed two high density polyethylene units, which included a total of eight particle form, loop reactor trains. The heat from the explosion caused BLEVEs (Boiling Liquid Expanding Vapour Explosion) of nearby pressure tanks. Other process units at this chemical complex sustained only minor damage and resumed normal production within a few weeks of the incident.

The initial release of ethylene and isobutane occurred through an 8 inch ball valve on the No 4 settling leg of a reactor. The major function of this pneumatic valve is to isolate the settling leg and other downstream equipment from the reactor for maintenance. The company maintenance procedures for opening a settling leg included closing the ball valve, inserting a lock-out device into this closed valve and closing the block valves to the air hoses.

After the explosions, investigations indicated that the lock-out device had been removed from the valve and the air hoses had been reconnected to the valve operator on settling leg No. 4. The ball valve was found in the open position and the settling leg was open to atmosphere at the bottom of the leg where a swedge spool leading to the product take off valve should have been connected.

A business interruption loss in excess of \$700,000,000 (1989).

[gas / vapour release, processing, maintenance inadequate, damage to equipment]

Lessons

[None Reported]

4747 17 October 1989

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1990, MAR.

Location : Rio De Janeiro, BRAZIL

Injured : 0 **Dead** : 0

Abstract

Bagged malt cargo on a marine transport vessel was polluted by a spill of potassium sorbate, isopropanol and sultafon when chemical drums spilt contents in heavy weather.

[weather effects, contamination]

Lessons

[None Reported]

4738 06 October 1989

Source : DAILY TELEGRAPH, 1989, 7 OCT.

Location : Whiston, UK

Injured : 0 Dead : 0

Abstract

A polyol and isocyanate were accidentally mixed causing a mile long gas cloud, resulting in the evacuation of people.
[accidental mixing, gas / vapour release]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 090, 11-12.; LLOYDS LIST, 1989, 24 AUG.; GUARDIAN, 1989, 5 JUN.; HAZARDOUS CARGO BULLETIN, 1989, AUG.

Location : Ufa; Siberia, RUSSIA

Injured : 706 **Dead** : 462

Abstract

Engineers in charge of an LPG pipeline carrying material from gas fields noticed a sudden drop in pressure at the pumping end of the pipeline. The pipeline was commissioned in 1985 to carry mixed LPG (propane, butane, pentane, methane and ethane) to feed an industrial city. Subsequently, it had been reported that there had been leaking for "several days" and that a heavy smell of gas had been reported a few hours before the explosions and fire. Instead of investigating the trouble, the engineers had responded by increasing the pumping rate in order to maintain the required pressure in the pipeline. The actual leakage point was about 890 miles down stream between two towns, where the pipeline was installed about 1/2 mile away to the side of a railway. The smell of escaping gas was reported from valley settlements in the area and it is also stated that the escaping liquefied gas formed two large pockets in low lying areas along the railway line. The gas cloud is reported to have drifted for a distance of 5 miles. Some hours later, two passenger trains, travelling in opposite directions, approached the area. Their turbulence mixed up LPG mist and vapour with the overlying air to form a flammable cloud section. One or the other train sparked off the cloud (electric overhead catenary wires for the locomotives) as an initial explosion.

Two explosions took place in quick succession followed by a wall of fire that was about 1 mile wide which raced down the railroad tracks in both directions. A considerable part of each train was derailed. Trees were flattened within a radius of 2 and a 1/2 miles from the explosion centre and windows were broken up to 8 miles away. Fatality.

[fire - consequence, operation inadequate, operator error, rail transportation, vapour cloud explosion, derailment - consequence, transportation, passenger train, injury]

Lessons

[None Reported]

4582 20 May 1989

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, JUL.

Location : Alma-Ata; Kazakstan, USSR

Injured : 100 **Dead** : 5

Abstract

A rail transportation incident. Two freight trains were in collision and one LPG tanker exploded destroying many homes. Fatality.
[explosion]

Lessons

[None Reported]

4580 17 May 1989

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, AUG.

Location : Immingham; Humberside, UK

Injured : 0 **Dead** : 0

Abstract

A marine transportation incident. Fire in marine tanker when residual jet fuel leaked through vacuum valve and ignited by cutting torch.
[fire - consequence, hot work]

Lessons

[None Reported]

4575 11 May 1989

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A fire occurred in a refinery plant. Equipment involved: pump. Substance involved: lube oil. Cause: excessive vibration.
[refining, fire - consequence]

Lessons

[None Reported]

4559 26 April 1989

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, JUL.

Location : Bandar; Abbas, IRAN

Injured : 0 **Dead** : 12

Abstract

During unloading of jet fuel from a marine tanker, a spillage occurred which ignited. Fatality.

[fire - consequence]

Lessons

[None Reported]

4546 16 April 1989

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A fire occurred on an offshore production platform. Equipment involved: engine. Substance involve:, lube oil. Cause: leak.
[fire - consequence]

Lessons

[None Reported]

4517 26 March 1989

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, JUN.

Location : Juaymah, SAUDI ARABIA

Injured : 0 **Dead** : 0

Abstract

A marine transportation incident. While berthing to load LPG a marine gas carrier hit trestle carrying gas pipelines from shore to loading manifold causing considerable damage.

[damage to equipment, collision]

Lessons

[None Reported]

4498 13 March 1989

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, MAY.

Location : Off Channel Islands, ENGLISH CHANNEL

Injured : 0 **Dead** : 0

Abstract

A marine transportation incident. A vessel sank in bad weather with pesticide cargo. Container of lindane floated free and taken in tow but subsequently lost.
[weather effects, sinking]

Lessons

[None Reported]

Source : ICHEME

Location : , JAPAN

Injured : 3 Dead : 0

Abstract

Corrosion inside one of the outlet headers of an air fin fan cooler was caused by iron sulphide scale deposits accelerated by increased chloride content of fluid which itself was caused by a process modification which had resulted in decreased flow rate. Corrosion caused release of hydrogen rich gas with oil which ignited giving an explosion which caused 800 window glass damage.

[solids deposition, modification procedures inadequate]

Lessons

There is a technical lesson to be learnt about the corrosion of carbon steel under iron sulphide scale deposit in fluid containing hydrogen sulphide, ammonia and water.

1. Corrosion is fairly accelerated by iron sulphide scale deposits.
2. Corrosion is accelerated by chlorides which are concentrated in the scale.
3. Corrosion speed increases under tensile stress.

Safety management system

1. For such desulphurisation plant, management system of operation and equipment should be intensified to discover early and to measure any abnormal condition such as local corrosion.
 2. Safety examination system should be reinforced for modification or new installation facilities.
-

11589March 1989

Source : THE GUARDIAN, 20 MAR, 1989; INDEPENDENT, 22 MAR, 1989; THE GUARDIAN, 23 MAR, 1989; THE TELEGRAPH, 23 MAR, 1989.

Location : , OFFSHORE - CHANNEL ISLANDS

Injured : 0 **Dead :** 0

Abstract

A marine transportation. A container of the toxic insecticide, lindane, was lost in the Channel, after a freighter on which it was being transported, sank off Guernsey.

The container was initially recovered by a French tug, but was lost during a storm as it was being towed to Cherbourg harbour.

Lindane, a toxic organochloride compound, lodges in the fatty tissue of animals and remains toxic for many years. The six tonnes of lindane in the container was therefore seen as a major threat to marine life in the Channel.

A major search, including French minesweepers, was undertaken to locate and recover the container, within a fifty square mile "exclusion zone".

Other toxic chemicals- permethrin and cypermethrine- were also being carried by the freighter when it sank. The British Government assumed responsibility for recovering these from the wreck of the freighter.

[container ship, sinking,

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, APR,; EUROPEAN CHEMICAL NEWS, FEBRUARY 27, 1989.

Location : Skikda, ALGERIA

Injured : 2 **Dead** : 27

Abstract

A marine transportation incident. A chemical tanker broke away from its moorings and sank in heavy gales.

During loading of 17 000 tonnes of liquefied natural gas (LNG), the vessel broke free in heavy weather damaging 4 loading arms. A small leakage of the product occurred.

The vessel dragged its anchors in the early hours, and was battered by force 10 winds and smashed on to the break water.

Out of a crew of 29 only two survived the incident.

[weather effects, damage to equipment, fatality]

Lessons

[None Reported]

Source : ICHEME

Location : Hull, UK

Injured : 0 Dead : 0

Abstract

A fire occurred in a dust collecting bag. No details were reported of injuries or damage. The process involving lime transfer generated lime dust which was considered a potential source of fire.

Four possible areas of electrostatic accumulation and subsequent discharge were identified and discounted as possible sources of ignition. Other potential sources of electrostatic charge generation were identified which could be eliminated by changes to equipment and procedures.

No definitive cause of the fire was identified. However, the polyethylene dust collecting bag was found to have high surface resistivity such that charging to potential of 5kV could occur by the action of installing the bag.

[fire - consequence, material transfer, container]

Lessons

1. Ignition could not be caused by electrical discharge caused by lime dust charge in the pneumatic conveying system because lime was not introduced into the process vessel until after the bag had caught fire.
 2. Lime should always be introduced into the slurry vessel below the liquid surface to minimise dust generation.
 3. The filter unit was not handling an amount of dust sufficient to generate a hazardous level of charge.
 4. The polythene dust collecting bag had a surface resistivity in excess of $10E14$ ohms per square metre, which could readily be charged to potential of 5kV by the action of installation.
 5. A metal buckle on the leather strap used to attach the dust collecting bag was an isolated conductor. The strap should be earthed.
 6. Potential sources of electrostatic charge generation may be identified by competent inspection of plant. Some sources may be readily eliminated.
-

4443 22 January 1989

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, APR.

Location : Cristobal, PANAMA

Injured : 0 Dead : 0

Abstract

A marine transportation incident. Marine tanker in collision with LPG gas carrier while preparing to enter canal. Gasoline leaked but no fire. Spill.

Lessons

[None Reported]

Source : COMMUNITY DOCUMENTATION CENTRE ON INDUSTRIAL RISK, MAJOR ACCIDENT REPORTING SYSTEM LESSONS LEARNT FROM ACCIDENTS NOTIFIED, INSTITUTE FOR SYSTEMS ENGINEERING AND INFORMATICS, COMMISSION OF THE EUROPEAN COMMUNITIES JOINT RESEARCH CENTRE, 1991, ISBN 9282622894.

Location : ,

Injured : 0 **Dead :** 0

Abstract

Production of PVC proceeded without adequate ammonia addition. Hence, the excess of HCl produced caused coagulation of the latex. The mixer failed but there was no indication of it. Consequently, a local overheating was caused since steam of 165-175 degrees C was used (latex starts decomposition at 140 degrees C), but this was not detected. An expansion of coagulated latex clogged all the piping including the inlet to the safety valve. Not compensated HCl started to react with the reactor material. Though the steam supply had been stopped and external cooling started, the vessel burst because the wall thickness had been reduced from 9.8 mm to 2 mm. Activation of the sprinkler system enhanced reactor cooling and diluted HCl vapours.

[mixing, runaway reaction, design or procedure error, damage to equipment]

Lessons

1. A substitution of the plasticising agent and use of steam with a maximum temperature of 127 degrees C (latex starts decomposing at 140 degrees C).
 2. Installation of a double signalling device on the mixer for the detection of malfunctions.
 3. Interlock of the steam supply to the mixer so that steam supply will be automatically shut off in the case of agitator failure.
 4. Installation of 2 independent temperature sensors. The steam supply will be automatically shut off in case any of the sensors indicates a temperature above 100 degrees C or when there is a substantial difference in the indications of the 2 sensors.
 5. Installation of a level switch which will automatically shut down the steam supply when a high level in the reactor is reached.
 6. All these steam shut-off actions will be coupled to an alarm indication in the control room. Batch control on quality, pH and persulphate content will be introduced.
 7. During the process the pH will be monitored through regular sampling; the possibility of continuous pH-monitoring will be investigated.
-

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

A fire occurred at a magnesium metal plant. Source of ignition was electrical short circuit. Equipment involved: substation.

[fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 2 **Dead :** 0

Abstract

An explosion and fire occurred at a plant during the recommissioning after bundle retubing of a kerosene reboiler in a crude distillation unit. The incident caused about £1 million (1989) worth of damage.

The kerosene reboiler had been out of service fore retubing. The incident occurred after re-installation of the tube bundle and hydrotesting of both the shell and tube sides.

The reboiler was despaded and recommissioning started by admitting kerosene at 148 degrees C to the tube side. Subsequently the shell side was backfilled from the outlet with hot long residue above its auto-ignition temperature.

Approximately 15 to 20 minutes after filling the shell side, the long residue inlet block valve was very slowly opened to start the long residue circulation. The progress of this operation was monitored by checking the warm-up of the uninsulated long residue inlet nozzle by hand feeling, using a ladder to reach it.

Approximately 5 minutes after the start of opening of the long residue inlet block valve, when it was 2 to 3 turns open, a sharp bang occurred. This was immediately followed by an outbreak of fire and heavy smoke development. Within a few minutes the unit was shutdown, using the emergency shutdown switches. The operator who had been checking the warm-up of the long residue inlet nozzle suffered first-degree burns. Both the operator and the supervisor, who was also in the area, were splashed with long residue.

The fire fed by leaking kerosene and long residue, took one and a quarter hours to extinguish.

Inspection of the reboiler after the incident clearly pointed to an explosive pressure increase in the shell as the cause of the product release and fire.

An investigation concluded that a hydrocarbon vapour explosion was more likely the cause of the pressure surge and subsequent leakage and fire.

[fire - consequence, high pressure, damage to equipment, injury]

Lessons

[None Reported]

Source : COMMUNITY DOCUMENTATION CENTRE ON INDUSTRIAL RISK, MAJOR ACCIDENT REPORTING SYSTEM LESSONS LEARNT FROM ACCIDENTS NOTIFIED, INSTITUTE FOR SYSTEMS ENGINEERING AND INFORMATICS, COMMISSION OF THE EUROPEAN COMMUNITIES JOINT RESEARCH CENTRE, 1991, ISBN 9282622894.

Location : ,

Injured : 0 **Dead :** 0

Abstract

During the manufacture of lubricating oil, there was a build-up of asphalt and other residual oils in the circulating propane system. This material was drained each shift from an accumulator vessel into a drain vessel, which is often flushed out with hot gas oil or flushing oil. The accumulator had a capacity of approximately 24 ton of propane (50 degrees C/21 bar). During the shift preceding the accident, the drain line from the drain vessel was found to be plugged; after an unsuccessful attempt to remedy this, the drain valve was closed. Draining of the asphalt and other residual oils from the circulating system into the drain vessel was started. About two hours later, a large quantity of propane escaped from the drain vessel and drifted 20-30 m towards the centre of the process plant. The operator noticed a gas cloud and at the same time, the propane low-level alarm sounded in the control room. The shift controller closed the valve between the propane recirculation system and the drain vessel manually. The on-site emergency services were called, but on their arrival the gas cloud had safely dispersed. The propane release was attributed to the plugging of the drain valve by a solid plug of asphalt and/or ice, preventing it from fully closing after draining. This plug became dislodged from the recirculation system to the drain vessel due to the propane pressure during draining. No double valve had been provided on the drain line and operating instructions did not adequately deal with the procedures to be followed in case of a blockage.

[gas / vapour release, design inadequate, refining, valve failure]

Lessons

1. An additional spring load valve will be installed in the drain line so as to close automatically when a blockage clears.
 2. Operating instructions have been updated to include a requirement that the drain vessel and its drain line should be flushed after each draining operation with gas-oil so as to prevent accumulation of solid asphalt.
 3. The drain system will be redesigned so that asphalt is drained from the vessel via a closed system, thereby removing the potential risk of a release to the atmosphere (inherent safe design).
-

4395 23 December 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, FEB.; THE SUN BALTIMORE, 1988, 24 DEC.; FIREHOUSE, 1989, APR.

Location : Memphis; Tennessee, USA

Injured : 6 **Dead** : 6

Abstract

A road transportation incident. LPG, mainly propane, road tanker skidded on highway exit ramp, broke through crash barrier and exploded on-top of a house.

Fatality.

[explosion]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, MAR.

Location : Walthamstow; London, UK

Injured : 0 **Dead** : 0

Abstract

A rail transportation incident. Derailment of rail tanker cars carrying gas, oil and kerosene. 3 cars leaked material into reservoir.

[spill]

Lessons

[None Reported]

4366 29 November 1988

Source : THE BLADE OHIO, 1988, 30 NOV.

Location : Flint; Michigan, USA

Injured : 66 **Dead :** 0

Abstract

A fire occurred in a plastics factory involving drums of isocyanate.

[fire - consequence]

Lessons

[None Reported]

4358 23 November 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, FEB.

Location : Kwangyang, SOUTH KOREA

Injured : 0 **Dead** : 0

Abstract

A marine transportation incident. Extensive damage to terminal and ship when it hit berth. Substance involved: iron ore.
[damage to equipment]

Lessons

[None Reported]

4351 14 November 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, JAN.

Location : , OFF COAST OF INDONESIA

Injured : 0 Dead : 3

Abstract

A marine transportation incident. A marine gas carrier laden with 413 tonnes of LPG sank in bad weather. Fatality.
[weather effects, sinking]

Lessons

[None Reported]

4322 19 October 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, DEC.

Location : Tokyo, JAPAN

Injured : 0 Dead : 0

Abstract

A rail transportation incident. Train with LPG in collision with train carrying packaged chemicals.
[unknown chemicals]

Lessons

[None Reported]

4315 13 October 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, DEC.

Location : Andover; Hampshire, UK

Injured : 1 **Dead** : 0

Abstract

An explosion occurred in a pyrotechnics factory caused by drums of magnesium catching fire.

[processing, fire - consequence, burns, fireworks]

Lessons

[None Reported]

4314 10 October 1988

Source : COMMUNITY DOCUMENTATION CENTRE ON INDUSTRIAL RISK, REVIEW OF ENVIRONMENTAL ACCIDENTS AND INCIDENTS, INSTITUTE FOR SYSTEMS ENGINEERING AND INFORMATICS & THE COMMISSION OF THE EUROPEAN COMMUNITIES JOINT RESEARCH CENTRE, 1992, ISBN 92 826 3535 X.

Location : Dampniat, FRANCE

Injured : 0 **Dead :** 0

Abstract

Accidental spill of lindane and sodium pentachlorophenate caused 15 ton fish kill and affected 14 km of a river.
[ecological damage]

Lessons

[None Reported]

4279 06 September 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, NOV.

Location : Maracaibo, VENEZUELA

Injured : 0 Dead : 0

Abstract

A marine transportation incident. A marine tanker was in collision with another. It then dropped anchor and ruptured an LPG pipeline.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 16 Dead : 0

Abstract

More than 16 people were affected by a release of about 250 litres of hydrofluoric acid/butane mixture from a passing drain valve.

The incident occurred during the start-up of an acid regenerator after a maintenance shutdown for minor repairs to the regenerator and depropaniser.

As soon as acid and isobutane were fed to the acid regenerator there was a leakage via a passing drain valve on the bottom of the relief gas scrubber into the open drain.

Shortly afterwards there was a high level alarm on the scrubber (two manual valving errors had resulted in the acid/isobutane feed to the regenerator being misdirected to the scrubber) and the startup was suspended.

The operators then decided to drain the scrubber (normal practice) and at this point discovered the passing drain valve. When the drain valve was cracked open the quantity of butane/acid released was greater than expected. The operator then had difficulty closing the valve fully using the valve spanner, after consulting his supervisor he used a 0.9 metre cheater bar for increased leverage/easier access and at this point the valve yolk sleeve failed allowing the valve to open resulting in a large uncontrolled release via the open drain.

Fortunately the operator had put a water hose in the drain while investigating the original source of the leak which probably washed most of the HF (hydrofluoric acid) down the drain and the release was further controlled by fire monitors, nevertheless, the HF concentration 500m downwind was estimated to be 5mg/m (UK recommended short term 10 minute exposure limit). The vapour cloud was estimated to be 10m high and 20m wide as it passed the bitumen blowing unit hot oil furnace (about 100m from the source) but did not ignite.

The causes of the incident can be listed as follows:

1. The drain line from the scrubber was discharged into an open drain.
2. The scrubber contained large amounts of HF/butane due to incorrect valving during startup.
3. The failure of the drain valve arose because of the valve design defect but also the use of a cheater bar to overcome difficulties in closing the valve (cause of valve operating difficulty not known).

[valve failure, gas / vapour release]

Lessons

1. Revise the acid regenerator startup and shutdown procedures differentiate between shutdown to depressure the regenerator and shutdowns to merely take the regenerator off line.
2. Revise the depropaniser startup and shutdown procedures to clarify what level of shutdown is intended for the acid regenerator.
3. Produce loose-leaf startup and shutdown procedures for the acid regenerator with provision for signing off each step.
4. The acid gas scrubber should be modified to provide an operable closed drainage system to the neutralising pit.
5. Alkylation Unit personnel should be advised of the need for correct clothing at all times.
6. Emergency procedures should be reviewed to ensure that sources of ignition are extinguished in the event of a gas leak.

4271 01 September 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, DEC.

Location : Mulhouse, FRANCE

Injured : 0 Dead : 0

Abstract

An explosion occurred in storage tank containing isopropyl alcohol and toluene. Fire destroyed plant, runoff water contaminated river.
[fire - consequence, pollution, storage tanks]

Lessons

[None Reported]

4249 11 August 1988

Source : COATES M & LOADER K, FPA CASEBOOK OF FIRES - PACKAGING WAREHOUSE, NORTHFLEET, KENT, FIRE PREVENTION, NUMBER 221, 1989, JUL/AUG.

Location : Northfleet; Kent, UK

Injured : 0 **Dead :** 0

Abstract

A fire occurred in a waste paper storage, packaging and furniture warehouse. LPG cylinders caused explosion. Sprinklers disconnected at time of fire.
[warehousing, fire - consequence]

Lessons

[None Reported]

4248 10 August 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, OCT.

Location : Killingly; Connecticut, USA

Injured : 0 **Dead** : 0

Abstract

A road transportation incident. A road tanker overturned spilling 1000 US gal of isopropyl alcohol.

Lessons

[None Reported]

4243 02 August 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, OCT.

Location : Brazoria; Texas, USA

Injured : 0 **Dead** : 0

Abstract

A rail transportation derailment. Several rail tankers of chemicals including, LPG, propyl alcohol, butyraldehyde and acetaldehyde derailed and caught fire.
[fire - consequence]

Lessons

[None Reported]

4237 25 July 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, OCT.

Location : Bridgeview; Illinois, USA

Injured : 4 **Dead** : 0

Abstract

An explosion occurred in a latex plant causing an evacuation.

Lessons

[None Reported]

4230 17 July 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, OCT; LLOYDS WEEKLY CASUALTY REPORTS; FIRE PREVENTION, 1989, MAR.

Location : Massa, ITALY

Injured : 20 **Dead** : 0

Abstract

An explosion of a 40 million cum (cubic metres) storage tank containing 45% solution of insecticide occurred releasing a toxic cloud causing pollution of the area. At around 0600 hours workers noticed that the tank's cooling system was losing nitrogen and the chemicals were overheating. Explosion minutes later. 3 smaller explosions. A little later fire followed. Plant permanently closed. 12 tonnes of pesticide released into atmosphere. 60,000 holiday makers had their holidays moved.

[fire - consequence]

Lessons

[None Reported]

4206 24 June 1988

Source : EUROPEAN CHEMICAL NEWS, 1988, 4 JUL.

Location : Port Arthur; Texas, USA

Injured : 0 **Dead** : 0

Abstract

Incident at ethylene cracker plant. Explosion damaged steam turbine in a propylene compressor in compressor house from lube oil failure.

[cracking]

Lessons

[None Reported]

4148 20 April 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, JUN.

Location : Ohara Bay, JAPAN

Injured : 0 Dead : 0

Abstract

A marine transportation incident. Explosion in a marine tanker's slop tank caused extensive damage to bow. Cargo, kerosene.

Lessons

[None Reported]

4133 28 March 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, MAY.

Location : Ras Tanura, SAUDI ARABIA

Injured : 0 **Dead** : 0

Abstract

Transportation. A bomb exploded under LPG pipeline, no major damage was caused.

[sabotage, explosion]

Lessons

[None Reported]

4120 10 March 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, APR.

Location : St.Charles; Louisiana, USA

Injured : 0 **Dead** : 0

Abstract

A road transportation incident. A road tanker overturned and skidded on bridge. The tank ruptured and a spill of jet fuel occurred.

Lessons

[None Reported]

4087 22 January 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, MAR.

Location : Off Ushant, FRANCE

Injured : 0 Dead : 0

Abstract

A marine transportation incident. A cargo ship lost deckload of 800 drums in bad weather. Substances involved: formic acid, hydrochloric acid and insecticide, propionic acid. Several drums washed ashore.

Lessons

[None Reported]

Source : COMMUNITY DOCUMENTATION CENTRE ON INDUSTRIAL RISK, MAJOR ACCIDENT REPORTING SYSTEM LESSONS LEARNT FROM ACCIDENTS NOTIFIED, INSTITUTE FOR SYSTEMS ENGINEERING AND INFORMATICS, COMMISSION OF THE EUROPEAN COMMUNITIES JOINT RESEARCH CENTRE, 1991, ISBN 9282622894.

Location : ,

Injured : 0 **Dead :** 0

Abstract

A crystalline finished product was spinning in a batch centrifuge when an explosion occurred. The product had been refrigerated to minus 7 degrees C before it was separated from a methanol/isopropanol mixture. It was subsequently washed with isopropanol pre-cooled to 9 degrees C. The mixture was spinning for about 5 minutes when the explosion occurred in the centrifuge. The lid of the centrifuge was blown off by the force of the explosion. The overpressure shattered nearby glass pipelines and windows inside the process area (up to 20 m away) but nearby plants were not damaged. As no operator was in the vicinity at the time of the explosion, no one was injured. No nitrogen inerting was used and enough time had elapsed to ensure that sufficient air could have been drawn into the machine to create a flammable atmosphere. Sufficient heat could also have been generated by friction to raise the temperature of the solvent medium above its flash point. The ignition of the flammable mixture could also have been caused by metal-to-metal contact between the basket and the bottom outlet chute of the centrifuge, leading to a friction spark, since the Teflon coating on the centrifuge basket was worn away, or by a static discharge (continuity checks failed to eliminate this latter possibility).

[overpressurisation, safety procedures inadequate, batch reaction, separation]

Lessons

[None Reported]

4062 1988

Source : ICHEME

Location : Porsgrunn, NORWAY

Injured : 0 **Dead :** 0

Abstract

A fire occurred on a conveyor belt in a magnesium plant. Source of ignition was welding.

[fire - consequence]

Lessons

[None Reported]

4003 30 October 1987

Source : LLOYDS LIST

Location : Lake Hamana, JAPAN

Injured : 0 Dead : 0

Abstract

A marine transportation incident. A chemical marine tanker carrying isopropyl alcohol in collision with ship. No chemical spillage.
[near miss]

Lessons

[None Reported]

3997 14 October 1987

Source : LLOYDS LIST

Location : Oigawa, JAPAN

Injured : 0 Dead : 0

Abstract

A marine transportation incident. A marine gas tanker in collision but no release of gas.

[marine tanker, near miss]

Lessons

[None Reported]

Source : ICHEME**Location :** , NEW ZEALAND**Injured :** 1 **Dead :** 0

Abstract

An explosion occurred in the kerosene furnace whilst attempts were being made to relight it.

Relighting of the furnace is initially a manual operation which was being supervised by the team leader assisted by a process operator recently appointed to the unit. There were a number of unsuccessful attempts to relight the furnace before it was realised that the LPG bottle for the portable ignitor was empty. The shift controller who was now on the scene proposed that the furnace should be repurged. It was shortly after this that the explosion occurred. This resulted in the process operator receiving facial burns, lacerations and fragmented debris in his eyes when the observation window was blown out. Damage to the furnace was limited to the burner throat assembly plate and the expansion joint on the air inlet ducting.

Investigation of the incident did not determine the cause exactly as the actions of the process operator were not witnessed and he was not able to significantly contribute to the investigations as he was unable to recall the events. However the investigating team came to the following conclusions based on circumstantial evidence.

The main steam purge valve was found open and the second valve cracked open. As the process operator was new to the unit it was assumed that on hearing the shift controller propose the furnace be repurged he interpreted this as meaning steam purging the fuel oil burner, not air purging the radiant cell as was intended. It is believed that while the team leader and shift controller were engaged in obtaining a replacement LPG bottle the process operator steam purged the fuel oil burner. This would have released two/three litres of fuel oil into the hot radiant cell where it rapidly vaporised and ignited from the adjoining common convection bank with the crude distiller furnace.

[operator error]

Lessons

It is an historical fact that the majority of furnace explosions occur during attempts to relight a hot furnace because of human failure in following laid down procedures. This particular incident is no exception as the main reason for the furnace explosion involved the failure to adhere to the written operating procedures, i.e. to ensure that the ignitor was lit and in position prior to pressurising fuel oil into the hot furnace.

When persons are unfamiliar with equipment or a process it is imperative that they are properly supervised at all times, and that proper training in the appropriate procedures is given.

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 1987, 4TH QUARTER.

Location : Dusseldorf, GERMANY

Injured : 0 **Dead** : 0

Abstract

A fire in a agrochemicals warehouse holding insecticides and rat poisons led to toxic effluent draining into recovery system.

[fire - consequence, warehousing]

Lessons

[None Reported]

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 1987, 4TH QUARTER.

Location : Aylesford; Kent, UK

Injured : 0 **Dead** : 0

Abstract

A road transportation incident. Valves deliberately opened on a parked road tanker caused a spillage of 20 000 litres of latex.
[deliberate acts]

Lessons

[None Reported]

Source : HEALTH & SAFETY AT WORK, OCTOBER 1987, PAGE 7.

Location : Balham, UK

Injured : 23 Dead : 3

Abstract

A confined explosion occurred in the basement of a four storey terraced building, destroying the building.

It is unclear whether the source of the explosion was a leak of natural gas, or a leak of LPG (a 15 kg butane cylinder was found in the rubble).

The LPG cylinder is believed to have been used for heating palm oil.

[fatality]

Lessons

[None Reported]

Source : SYDNEY DAILY TELEGRAPH, 1990, 3 APR.

Location : Cairns, AUSTRALIA

Injured : 27 Dead : 1

Abstract

An explosion of a rail tanker containing 5000 litres of LPG occurred, many houses were engulfed. An employee climbed onto the top of the tanker to connect the flexible discharge hoses to the liquid and vapour outlets. As this was completed a liquid transfer hose broke free, discharging the liquid freely and forming a visible vapour cloud which spread outwards across the yard. The excess flow valve did not operate, and the liquid discharge continued. The employee immediately closed valves to isolate the tanker and began to evacuate the yard. The cloud was ignited by the pilot flame of a gas-fired hot water system in a nearby house. The flame flashed through the vapour cloud, and a fierce fire developed around the tanker. The tanker BLEVE'd (Boiling Liquid Expanding Vapour Explosion) shortly after, the tanker rupture occurring near the top (over the vapour space). Fatality.

[unloading, vapour cloud explosion, fire - consequence, material transfer]

Lessons

[None Reported]

Source : ICHEME

Location : , SOUTH AFRICA

Injured : 0 Dead : 0

Abstract

A debutaniser reflux pump, which normally pumps LPG (mainly butane), had become blocked with hydrates. Whilst the pump was dismantled for maintenance, a solid deposition of ice and hydrates in the isolation valve was melted using a steam hose, allowing a major release of LPG. This was ignited on a near-by furnace and resulted in a vapour cloud explosion. The ensuing fire lasted for about 100 minutes and the fire consequences, were severe involving major damage to equipment, and a prolonged plant shut-down.

[training inadequate, safety procedures inadequate, fire - consequence, damage to equipment, plant shutdown]

Lessons

Training inadequate the properties of hydrates was not understood, and it was mistaken for ice. Safety procedures inadequate due to lack of understanding the exact point of release was not communicated to the emergency team for over 30 minutes.

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 3RD QUARTER, 1987.

Location : Brisbane, AUSTRALIA

Injured : 0 **Dead** : 0

Abstract

A fire occurred in a gas container which led to an explosion of a rail tanker car containing 3 tonnes of LPG during unloading operations.

[fire - consequence]

Lessons

[None Reported]

3928 12 June 1987

Source : LLOYDS LIST, 1987, 15 JUN,; FIRE PREVENTION 205, DECEMBER 1987.

Location : Tarragona, SPAIN

Injured : 0 **Dead** : 0

Abstract

An explosion occurred in a pipe rack between a refinery and a terminal. The rack contained pipelines carrying from crude to petrochemicals. Preparations were being made for repairs at the time of the explosion. Five tanks were destroyed and others damaged, 3,000 tonnes of crude oil, fuel oil and kerosene went up in smoke. Sabotage suspected. Pipeline.

[refining, fire - consequence, damage to equipment]

Lessons

[None Reported]

3924 08 June 1987

Source : HAZARDOUS MATERIALS INTELLIGENCE REPORT, 1987, 12 JUN.

Location : Vinita; Oklahoma, USA

Injured : 0 **Dead** : 0

Abstract

A road and rail transportation incident. A truck tried to cross the track in front of a train. 27 rail tanker cars derailed and 35 000 galls of hazardous chemicals, lubricating oil and solvent waste were spilt,
[derailment]

Lessons

[None Reported]

3909 17 May 1987

Source : LLOYDS LIST, 1987, 26 MAY.

Location : Mina Al Ahmadi, KUWAIT

Injured : 0 **Dead** : 0

Abstract

A fire occurred in LPG storage tank halted export of products from terminal. Sabotage suspected.

[fire - consequence, storage tanks]

Lessons

[None Reported]

3887 04 April 1987

Source : HAZARDOUS MATERIALS INTELLIGENCE REPORT, 1987, 10 APR.

Location : Minot; South Dakota, USA

Injured : 1 **Dead** : 0

Abstract

A fire occurred in a warehouse containing pesticides, herbicides and other agricultural chemicals, including lindane, parathion and malathion. 10000 nearby residents were evacuated.

[evacuation, warehousing, fire - consequence]

Lessons

[None Reported]

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 1987.

Location : Equador, COLOMBIA

Injured : 0 **Dead :** 0

Abstract

Transportation. 25 miles of oil pipeline disappeared after earthquake which also damaged a LPG pipeline.
[damage to equipment]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN 094, 1-6; INDEPENDENT, 1987, 16 JAN.; PURDY G & SMITH E.J, THE LESSONS LEARNT FROM EMERGENCIES IN THE U.K. INVOLVING HAZARDOUS CHEMICALS, EMERGENCY PLANNING 91, SYMPOSIUM, SEP.,1991

Location : Portswood; Southampton, UK

Injured : 22 **Dead** : 0

Abstract

This incident occurred in winter in sub-zero temperatures. A road tanker delivered waste pharmaceutical material for incineration. The waste consisted principally of isopropyl alcohol, methanol, acetone and water, and small amounts of methyl mercaptan, carbon disulphide, dimethyl sulphide and dimethyl disulphide. Approximately 50 percent of the waste had been unloaded from the tanker when a valve failure via a weld, was found and the emptying process was halted by closing the valve and partially vacuuming the tank. The decision was made to return the tanker to a depot for repair. On reaching the depot the vehicle was reversed into the workshop and a fitter was instructed to remove the outlet pipe. The fitter then proceeded to remove the discharge pipe by unbolting the flange securing the pipe to the lower of two valves. No separate check appears to have been made of the status of the two valves, it being assumed from the observed fact that the valves were not leaking that they were in fact closed. The discharge pipe was successfully removed and taken to the back of the workshop for cleaning in solvent. Shortly afterwards it was noticed that a slight drip had developed from the valve, and a bucket was placed underneath. A vacuum was applied to the tank and the drip aroused no more concern. However, after a few minutes the leak rapidly worsened and what was thought to be solid debris or sludge was seen to fall out of the valve and then the contents of the vehicle began to flow. After investigation it was found that the lower seat and ball had in fact fallen out of the bottom of the valve, and could have been what was thought to be sludge. The top valve could not have been closed, thus allowing an escape of the contents. Approximately 1,700 gallons flooded on to the ground and out of the workshop. Some of the drains were frozen allowing the waste to run for a distance. Evacuation of residents in an area of one mile followed due to the strong smell and unpleasant vapour cloud formed.

[unloading]

Lessons

[None Reported]

3838 07 January 1987

Source : HAZARDOUS MATERIALS INTELLIGENCE REPORT, 1987, 9 JAN.; LLOYDS LIST, 1987, 8 JAN.

Location : East Allen Township; Pennsylvania, USA

Injured : 24 **Dead** : 1

Abstract

An explosion of a reaction vessel containing acrylonitrile, sulphuric acid and isopropyl alcohol occurred, which was mixed to make paint. Material released into the surrounding area. Evacuation. Fatality.

[leak]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

The motor operator was to be removed from an LPG valve for repair. However, the maintenance man started to remove the nuts holding down the valve bonnet rather than the topworks. A serious leak resulted. Fortunately it was possible to block in the line containing the valve.

[preparation for maintenance, automatic valve, blowout, maintenance procedure error, contractor error, spill]

Lessons

1. Maintenance men must either be very familiar with the detail of all the equipment they work on or be shown exactly what they are required to do on each job.
 2. With the great increase in use of contract maintenance the former is more difficult to achieve
-

3821 27 December 1986

Source : NEUHOFF S, EXPERIENCE GAINED FROM RECENT MAJOR ACCIDENTS IN THE FEDERAL REPUBLIC OF GERMANY, IN: GOW H.B.F & KAY R.V. (EDS), EMERGENCY PLANNING FOR INDUSTRIAL HAZARDS, PROCEEDINGS OF THE EUROPEAN CONFERENCE ON EMERGENCY PLANNING, VARESE, ITALY, 4-6 NOV., 1987, ELSEVIER, 1988, 243-249.

Location : Garmisch; Partenkirchen, GERMANY

Injured : 8 **Dead** : 11

Abstract

A hotel was heated by a gas fired boiler from a 64 m3 LPG tank. On the day of the incident a relief valve lifted when the tank was 54% full. 15 minutes later the gas cloud ignited. Gas in the basement ignited to give explosion and this ignited the gas from the relief valve. The tank overpressured due to a hot water heating system for the tank which could cause it to overpressure. Fatality.

[vapour cloud explosion, overpressurisation]

Lessons

The following remark was made. There is no technical need for a heating system for liquefied gas tanks, as increased amounts of gas can be removed through an evaporator.

3814 20 December 1986

Source : LLOYDS LIST, 1986, 24 DEC.; MARINE ACCIDENT REPORT, EXPLOSION AND FIRE ABOARD THE TANK BARGE..., NATIONAL TRANSPORTATION SAFETY BOARD, WASHINGTON D.C, USA, REPORT NUMBER NTSB/MAR-87-09, 1987

Location : Piney Point; Maryland, USA

Injured : 1 **Dead** : 4

Abstract

A marine transport incident. An explosion followed by a fire occurred on a petroleum tanker barge. At the time of the explosion workers were cleaning the barge tanks which had previously contained jet fuel. Fatality.

[fire - consequence]

Lessons

[None Reported]

3797 29 November 1986

Source : SYDNEY DAILY TELEGRAPH, 1990, 3 APR.

Location : Rhodes, AUSTRALIA

Injured : 0 Dead : 5

Abstract

A LPG Explosion. Fatality.

Lessons

[None Reported]

3756 17 October 1986

Source : THE SUN BALTIMORE, 1986, 18 OCT.

Location : Glen Burnie; Baltimore, USA

Injured : 0 Dead : 0

Abstract

A road transportation incident. A road tanker overturned as it was turning causing a kerosene spill.

Lessons

[None Reported]

1130201 October 1986

Source : MANCHESTER EVENING NEWS, 1 OCTOBER, 1986.

Location : Manchester, UK

Injured : 20 Dead : 0

Abstract

A road transportation incident. Twenty tonnes of hydrated lime dust leaked from a road tanker. When firemen arrived at the site 10 people were lying in the road covered with lime dust. 10 workers were taken to hospital, as were 10 firemen who rescued workers from a mountain of lime dust. One worker was buried up to his waist. Five workers were given oxygen at the site. None of the workers were seriously hurt. The accident happened as the tanker was discharging lime through a pipe into a silo, when the pipe fractured. The lime was to be used in cement manufacture. There was a small dust cloud, but as the winds were light the cloud was confined within the works perimeter. When lime dust comes into contact with moisture it becomes very corrosive and can cause serious burns to the eyes and skin.

[silo/hopper, unloading, loading, injury]

Lessons

[None Reported]

11261October 1986

Source : THE SAFETY PRACTITIONER, OCT, 1986.

Location : ,

Injured : 1 Dead : 0

Abstract

An industrial painter died of burns whilst painting the inside of a pipe 1.37 metres diameter on a hillside slope of a gradient of 1 in 4. A LPG gas powered lamp used for illumination inside the pipe was knocked over and rolled down setting a paint tray alight. The paint contained thixotropic gelled bitumen with a flash point of 32 degrees C.

The owners of the site had dewatered the pipe and issued a permit to work. The contractors had specified that low voltage flame proof lighting would be used. The painter attempted to get past the flames to the exit but his paint soaked overalls were ignited. The contractor was fined £1250 (1986).

[contractor error, hot work, injury]

Lessons

Use correctly specified low voltage flame proof lighting when working in confined spaces.

Source : THE SAFETY PRACTITIONER, OCT, 1986.**Location :** ,**Injured :** 0 **Dead :** 2

Abstract

An LPG explosion in a garage killed two people, seriously injured two others and caused minor injuries to a number of members of the public who were nearby. Several months before the incident a 60 litre LPG vehicle, which was approximately one third full, had been removed from a transit van and placed in a storeroom in the back corner of the ground floor of the premises. During a clean up of the premises the on-off tap of the tank was accidentally struck with a sweeping brush allowing LPG to escape. This formed a cloud of aerosol droplets which evaporated and could be seen pouring into the garage and the heavy gas spread over the floor and into the vehicle pit. The premises were evacuated and about 5 minutes later the foreman managed to turn the tap off. The garage employees stayed on the forecourt for 20 minutes and then returned. They could no longer see the aerosol cloud as it had vaporised and could not smell gas.

Shortly after they re-entered the garage one of the men went to wash his hands in the toilets. There was an explosion which destroyed the whole building. It was thought that the gas fired water heater was the source of ignition.

[evacuation, gas / vapour release, hot surface, fatality, damage to equipment, cleaning, storage]

Lessons

The following recommendations were made:

1. LPG-fuelled vehicles should not be serviced over or near pits as LPG may build up in the pit.
 2. When tanks are removed from vehicles they should be kept in a safe place in the open air or in a properly constructed store.
 3. If a tank is not being replaced on a vehicle consideration should be given to emptying it by a safe method and purging it of residual LPG vapour.
-

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

Operators lost control of a batch polymerisation reactor when the temperature was (intentionally) raised from 37 degrees C to 38 degrees C. The bursting disc blew and relief valve lifted, discharging the reactor contents to a salvage tank. No other damage was sustained.

Similar incidents had occurred with this grade of polymer on 4 or 5 previous occasions over a period of 10 years. The grade of latex being made had an unusually high monomer content and was known to be difficult to control.

[reactors and reaction equipment, exothermic reaction, overheating, instrumentation failure, overpressure, gas / vapour release, product loss, batch reaction]

Lessons

Investigation showed that the temperature controller terms were poorly set up (integral time of 2 seconds instead of 1 minute).

Longer term, improved methods of catalyst control were recommended.

3711 23 August 1986

Source : NEW YORK TIMES, 1986, 24 AUG.

Location : New York, USA

Injured : 0 **Dead :** 0

Abstract

Leak of isobutylene from a tank holding 2500 usg. Area cordoned off.

Lessons

[None Reported]

3708 18 August 1986

Source : HAZARDOUS MATERIALS INTELLIGENCE REPORT, 1986, 5 SEP.

Location : Newark; Delaware, USA

Injured : 9 **Dead :** 0

Abstract

An explosion and fire occurred in a pharmaceuticals factory. Wall and roof of 2 storey building blown-out. Said to be due to operator error in mixing process. The fire consumed approximately 3 000 pounds of chemicals, including glycerine, iodine, nitro amino anisole, and 100 pounds of sulphuric acid.
[fire - consequence]

Lessons

[None Reported]

3699 10 August 1986

Source : NEW YORK TIMES, 1986, 11 AUG.

Location : California, USA

Injured : 0 **Dead :** 0

Abstract

A rail transportation incident. Derailment of 7 rail tanker cars, 3 containing isobutane. Evacuation of 3000 people. No release.

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A road transport incident. Twenty tonnes of hydrated lime were released from a road tanker during a delivery to a cement plant. This was caused by the fracture of the delivery pipe. A small dust cloud was produced which was confined within the site boundaries. One worker was buried up to his waist and was pulled clear by colleagues. Ten workers in all were taken to hospital and five workers were given oxygen on site. The injuries if any are reported as unknown.

[unloading, spill, material of construction failure]

Lessons

[None Reported]

3682 28 July 1986

Source : NEW YORK TIMES, 1986, 30 JUL.

Location : Boone; Iowa, USA

Injured : 6 Dead : 0

Abstract

A rail transportation incident. High winds blew rail tankers off bridge causing rupture of containers and spillage of insecticide. Evacuation.

[Strong winds]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, 1986, OCT., 75.

Location : Petal; Mississippi, USA

Injured : 12 **Dead** : 0

Abstract

A sudden explosion in a LPG separation, storage and distribution centre was followed by a second explosion, large fireball, and fires with flames over 100 feet high, and led to the evacuation of residents within a 2 kilometre diameter zone.

LPG was stored in above ground horizontal bullets and in underground brine displacement salt dome cavities.

Subsequent investigation found that there had been a leak of LPG gas from an underground pipeline owned by one of the site operators, saturating the ground before forming an above ground LPG/air cloud, which was eventually ignited (by an unknown ignition source).

[fire - consequence]

Lessons

[None Reported]

3678 21 July 1986

Source : NEW ZEALAND HERALD, 1986, 6 AUG.

Location : Auckland, NEW ZEALAND

Injured : 0 **Dead** : 0

Abstract

Leak of up to 1,000 000 litres of kerosene from an oil storage tank into a harbour and into water table. Pollution. Spill.
[storage tanks]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A release of LPG occurred on an HF alkylation unit in a refinery. The gas was released over a period of one and a half hours. Fortunately the gas cloud did not ignite. There were no injuries to personnel.

An investigation into the incident concluded that the LPG had been released from a hole caused by excessive localised internal corrosion of the outlet pipework of one of the two parallel isobutane recycle heat exchangers. A build up of iron fluoride deposits over a period of time in the outlet pipework had set up an environment which had allowed rapid localised corrosion to take place which had not been identified.

[leak, gas / vapour release]

Lessons

[None Reported]

3552 21 February 1986

Source : LLOYDS LIST, 1986, 22 FEB.

Location : Salisbury; Wiltshire, UK

Injured : 2 **Dead** : 1

Abstract

Explosion at pyrotechnic factory involving magnesium. Fatality.

Lessons

[None Reported]

3549 17 February 1986

Source : CANADIAN OCCUPATIONAL HEALTH AND SAFETY NEWS, 1986, 17 FEB.

Location : Ontario, CANADA

Injured : 8 + **Dead :** 0

Abstract

A fire occurred in a bin during the packing of powdered azinphos-methyl insecticide. Dozens of firemen also treated in hospital.

[fire - consequence, processing]

Lessons

[None Reported]

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 1986.

Location : Edmonton, CANADA

Injured : 3 **Dead** : 2

Abstract

Transportation. Leak of liquefied natural gas (LNG) from pipeline at a cracked weld due to downward bending because of poorly compacted backfill or frost heave during repair. Contractors allowed gas cloud to reach internal combustion engines. Fireball. Explosion. Fatality.
[vapour cloud explosion, fire - consequence]

Lessons

[None Reported]

3517 21 January 1986

Source : TORONTO GLOBE & MAIL, 1986, 19 MAR.

Location : Stoney Creek, CANADA

Injured : 0 Dead : 0

Abstract

A fire occurred in a hopper following decomposition of the insecticide azinphos-methyl. 1000 residents fled.

[human causes, maintenance inadequate]

Lessons

[None Reported]

3506 07 January 1986

Source : MORNING STAR, 1986, 8 JAN.

Location : Warrington; Cheshire, UK

Injured : 1 **Dead** : 1

Abstract

Explosion in bitumen and kerosene tank while welder working above. Fatality.

[welding, spark]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

In unscrewing a nipple from a ball valve on a drain line the end cap of the valve unscrewed instead of the nipple. This end cap holds the ball in the valve so there was a large leak of LPG. Luckily there was another valve upstream which could be closed off.

[repair, blowout, incorrect equipment installed, maintenance procedure error]

Lessons

Maintenance workers should be warned that there are dangers in unscrewing any fitting on an operating plant. They must ensure that the joint which unscrews is the intended one and not another which is under pressure.

This design of ball valve is intrinsically unsafe in any service where the end cap might be unscrewed in error. It should not be used for such services as there are alternative designs available without this fault.

Source : COMMUNITY DOCUMENTATION CENTRE ON INDUSTRIAL RISK, MAJOR ACCIDENT REPORTING SYSTEM LESSONS LEARNT FROM ACCIDENTS NOTIFIED, INSTITUTE FOR SYSTEMS ENGINEERING AND INFORMATICS, COMMISSION OF THE EUROPEAN COMMUNITIES JOINT RESEARCH CENTRE, 1991, ISBN 9282622894.

Location : ,

Injured : 0 **Dead :** 0

Abstract

Due to corrosion in an isobutane recycle piping system, operating at 15 bar/84 degrees C, an emission of LPG containing traces of hydrogen fluoride occurred. Early identification of the leak was by gas detectors. The plant was taken through a controlled de-pressurisation sequence over the period of one hour so that a temporary repair could be made. Examination of the ASME A106 (8" bore) x 8 mm, grade 13 steel pipe revealed that a plug of rust and sludge containing 9.9% FeF₂, 8.1% FeF₃ and 37.59% Fe₂O₃ had accumulated in the base of a shallow bend. The retention of HF (hydrogen fluoride) in this plug had caused accelerated internal corrosion in a localised zone around the surface of the plug. The pipe formed part of the original installation which had been in use for about 5 years. Generally, the corrosion was uniform and within the tolerance allowed for the recycle circuits of the plant.

[processing]

Lessons

[None Reported]

3471 17 December 1985

Source : THE EVENING SUN, 1985, 17 DEC.; DAILY TELEGRAPH, 1985, 18 DEC.; NEW YORK TIMES, 17 DEC, 1985, 18 DEC, 1985.

Location : Glenwood Springs; Colorado, USA

Injured : 13 **Dead :** 11

Abstract

A 1,000 gallon propane tank exploded at a gas company offices and repair garage, killing 12 people and injuring a further 13. The tank was on a flatbed truck that had just pulled in to a repair bay. It seems that someone was carrying out maintenance work on a leaking valve on the tank when the valve 'burst', releasing liquefied gas. It may be that the worker made an error in dismantling the valve.

Sources of ignition for the explosion were variously quoted as a welding torch, the pilot light on a gas water heater, and a hot air gun.

[LPG, fatality, maintenance procedure error, standards inadequate, operator error, injury]

Lessons

[None Reported]

3465 06 December 1985

Source : BBC NEWS, 1985, 6 DEC.

Location : Warwick, UK

Injured : 0 **Dead :** 0

Abstract

An explosion at university caused by leak of gas from an LPG cylinder.

Lessons

[None Reported]

3435 02 November 1985

Source : SEDGWICK LOSS CONTROL NEWSLETTER

Location : Jurong, SINGAPORE

Injured : 0 Dead : 0

Abstract

Deposits of coke on trays in distillation column ignited by spontaneous combustion of iron sulphide causing fire. Carbon.
[fire - consequence]

Lessons

[None Reported]

3415 10 October 1985

Source : LLOYDS WEEKLY CASUALTY REPORTS, 1985, 22 OCT.

Location : Willesden Junction; London, UK

Injured : 0 **Dead** : 0

Abstract

A rail transportation incident. Rail tanker carrying kerosene and gas oil partially derailed. Slight spillage from 2 tankers.
[derailment]

Lessons

[None Reported]

3412 09 October 1985

Source : ILR RADIO, 1985, 9 OCT.

Location : Milford Haven, UK

Injured : 0 Dead : 0

Abstract

A rail transportation incident. A rail tanker of kerosene overturned causing spillage of 14000 ukg.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Failure of computer caused all diaphragm valves which were not spring loaded to lose the ability to close tightly concentrated sulphuric acid, glycol, isopropanol then leaked into an resin bed causing pressure and lifting of relief valve.

[computer failure, overpressure]

Lessons

[None Reported]

3360 29 July 1985

Source : COMMUNITY DOCUMENTATION CENTRE ON INDUSTRIAL RISK, REVIEW OF ENVIRONMENTAL ACCIDENTS AND INCIDENTS, INSTITUTE FOR SYSTEMS ENGINEERING AND INFORMATICS & THE COMMISSION OF THE EUROPEAN COMMUNITIES JOINT RESEACH CENTRE, 1992, ISBN 92 826 3535 X.

Location : Thunderbolt Reef; Cape Recife, SOUTH AFRICA

Injured : 0 **Dead** : 0

Abstract

A marine transportation incident. Marine tanker went aground and released 513 cum of oil mixture, diesel, fuel oil, lubricating oil. Spill.
[ship ran aground]

Lessons

[None Reported]

3330 15 June 1985

Source : LLOYDS LIST, 1985, 18 JUN.

Location : Coatzacoalcos, MEXICO

Injured : 15 **Dead** : 2

Abstract

During loading a flexible hose failed and caused spillage of LPG at jetty which enveloped the marine tanker and caught fire. Fatality.
[fire - consequence]

Lessons

[None Reported]

3311 12 May 1985

Source : LLOYDS LIST, 1985, 14 MAY.

Location : , RECIFE

Injured : 0 Dead : 0

Abstract

A marine transportation incident. LPG marine tanker caught fire while unloading.

[fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A tanker was being loaded with fuel oil. To achieve a higher filling rate a second transfer pump was lined up and remotely started from the control centre. One hour later the pump tripped and within a few minutes a fire occurred in the pumphouse which took one and a half hours to extinguish. No one was injured but the mechanical damage was extensive and repair costs are estimated at about £276,000 (1985).

Investigation revealed that on the previous day the standby pump had been reported to have a lube oil leak but this had not received attention. This probably resulted in the mechanical failure of the pump bearing. The pump vibration apparently caused a flange on the discharge pipework to open with the resultant oil spray being ignited by the hot pump bearings.

[bearing failure, excessive vibration, loading, fire - consequence, damage to equipment]

Lessons

The following recommendations were made:

1. Remote shutdown switches to be installed locally and at the appropriate control centre.
 2. Remotely operable motorised valves with manual override (external to pumphouse installations) to be installed on all suction lines. Valves to be remotely operated from a wall mounted switch outside the pumphouse and from the appropriate control centre.
 3. Fire detectors of the ultra violet flame sensing type to be provided. The system to alarm locally as well as to the appropriate control centre and to be fitted with audible alarms.
-

Source : LESSONS LEARNED FROM EMERGENCIES AFTER ACCIDENTS IN FRANCE INVOLVING DANGEROUS SUBSTANCES, EEC

Location : Saint Priest, FRANCE

Injured : 0 **Dead** : 0

Abstract

A road transportation incident. A road tanker reversed and ruptured causing liquified gas, LPG, to escape. Spill. Transfer proved impossible and the entire liquid phase escaped and vapourised. The gas was burnt off by a torch.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A fire and explosion occurred on lube oil hydrotreater on a refinery. A malfunction of the lube oil hydrotreater resulted in an explosion and fire. The proper action was not taken when problems in the unit developed. It was found that inexperienced operators were involved in the block switching procedure which had only been carried out on one previous occasion.

[training inadequate, fire - consequence, refining]

Lessons

When operators are required to make process changes for the first time or very rarely, senior staff should ensure that the operators are provided with sufficient information as to what to expect.

When unexpected conditions develop on a unit, operators must draw these to the immediate attention of more senior staff.

Source : HAZARDOUS CARGO BULLETIN, 1985, MAR.

Location : Petawawa, CANADA

Injured : 0 Dead : 0

Abstract

A rail transportation derailment was caused by a cracked rail led to fire involving rail tankers of sodium nitrate and lubricating oil.
[fire - consequence]

Lessons

[None Reported]

3237 21 February 1985

Source : HAZARDOUS MATERIALS INTELLIGENCE REPORT, 1985, 1 MAR.

Location : New Jersey, USA

Injured : 0 Dead : 0

Abstract

A fire and explosion occurred in a warehouse. Aerosol cans containing isobutane burned and exploded.

[fire - consequence]

Lessons

[None Reported]

3203 14 January 1985

Source : RADIO NEWS, 1985, 15 JAN.

Location : Newport; Gwent, UK

Injured : 0 **Dead :** 0

Abstract

A road transport incident. 35 families were evacuated when a leak occurred in a drum of isopropyl alcohol on a lorry which had been parked in a residential area. Spill. Evacuation.

Lessons

[None Reported]

Source : COMMUNITY DOCUMENTATION CENTRE ON INDUSTRIAL RISK, MAJOR ACCIDENT REPORTING SYSTEM LESSONS LEARNT FROM ACCIDENTS NOTIFIED, INSTITUTE FOR SYSTEMS ENGINEERING AND INFORMATICS, COMMISSION OF THE EUROPEAN COMMUNITIES JOINT RESEARCH CENTRE, 1991, ISBN 9282622894.

Location : ,

Injured : 0 **Dead :** 1

Abstract

An ignition of gas coming from a leaking flange initiated a jet fire which caused the blast of the fractionating column and the explosion of 3 tanks containing ethylene, propylene and LPG. The explosions were very powerful, but it was not necessary to evacuate the zone. One person was found dead outside the establishment.

Although the fire was under control it continued for many days. Jet fires were not extinguished to avoid the formation of explosive clouds. A flare connected to various points of the plant was set up to accelerate the exhaustion of the fire. Various fires in a radius of 60 m were extinguished. Fatality.

[fire - consequence, flange leak, processing]

Lessons

[None Reported]

9690 1985

Source : ICHEME

Location : , AUSTRALIA

Injured : 0 Dead : 0

Abstract

A fire occurred on a reactor charge pump as a result of loss of lubricating oil to the bearings due to the lubricating oil return line being fractured at a screwed coupling. Failure of the pump seals then allowed the reactor charge to flood the pump bed, with ignition from the overheated bearings. Dry powder extinguished, cost estimate £7,000 (1985).

[fire - consequence, reactors and reaction equipment]

Lessons

[None Reported]

Source : COMMUNITY DOCUMENTATION CENTRE ON INDUSTRIAL RISK, MAJOR ACCIDENT REPORTING SYSTEM LESSONS LEARNT FROM ACCIDENTS NOTIFIED, INSTITUTE FOR SYSTEMS ENGINEERING AND INFORMATICS, COMMISSION OF THE EUROPEAN COMMUNITIES JOINT RESEARCH CENTRE, 1991, ISBN 9282622894.

Location : ,

Injured : 0 **Dead :** 0

Abstract

Chlorine was used to remove magnesium from a melt. The plant has normally two 500 kg chlorine cylinders located in a special, partly open, room. One cylinder is connected to the chlorination unit while the other is held as a spare. The closing valve on the cylinder is provided with an extension rod, which may close the valve from outside in emergencies. The valve stem and the threaded bushing of the rod had apparently been unscrewed by force, overriding the locking provided by a locking screw. Following this, the bushing and the valve stem were ejected or pulled out, causing leakage of chlorine. When the leakage occurred, the chlorine evaporator was in operation, indicating that the chlorination system was either in operation or being prepared for operation.

The police was warned by a person outside the establishment, who smelled the chlorine, also the fire brigade intervened. The area around the establishment was sealed and a warning to the public was given through the broadcasting system.

The fire brigade located the chlorine release and stopped the leakage about 2 hours after the police was called by refitting the bushing and the valve stem.

Chlorine concentrations at the establishment fence were estimated to be in the order of 6-20 ppm.

[processing]

Lessons

After this accident, it was recommended to provide the extension rod with a one-way ratchet key assuring that its operation from outside permits only the valve closure.

3158 11 December 1984

Source : LLOYDS LIST, 1984, 13 DEC.

Location : , BELGIUM

Injured : 0 Dead : 0

Abstract

Transportation. Six bombs caused rupture and explosion of jet fuel, oil, pipeline. One bomb caused serious damage to a pumping station. Terrorism.
[damage to equipment]

Lessons

[None Reported]

3143 19 November 1984

Source : MARSHALL V.C, MAJOR CHEMICAL HAZARDS;100 LARGEST LOSSES, 9TH EDITION, MARSH & MCLENNAN PROTECTION CONSULTANTS, 1986;

Location : San Juan Ixhuatepec, MEXICO

Injured : 7231 **Dead :** 500

Abstract

Some 11,000 m³ of liquefied petroleum gas (LPG) was stored in six 1600 m³ spheres and 48 horizontal cylindrical bullets, all in close proximity. The legs of the spheres were not fireproofed. It is believed that no fixed water sprays or deluge systems were fitted to the tanks. A leak of LPG from an unknown source formed a vapour cloud which was ignited by a plant flare. The storage area was banded into 13 separate areas by walls about 1 m high. A fierce fire developed, engulfing the spheres which went up one after the other in a series of BLEVEs (Boiling Liquid Expanding Vapour Explosion). Nine explosions were recorded. This series of LPG explosions at the distribution centre resulted in 542 fatalities and over 7000 people being injured. Some 200,000 people were evacuated. The fireballs were up to 300 m in diameter and lasted as long as 20 seconds. Rain consisting of liquid droplets of cooled LPG fell over the housing area covering people and property. It was set alight by the heat from the fireballs. Since the construction of the plant some 100,000 people had settled in crowded housing on the valley floor and slopes. This had spread to within 130 m of the plant. The local housing was mainly single storey and built of brick between concrete pillars. At least five people lived in each home. LPG was used for heating and cooking and each household had its own small bottles. Some 2000 houses at 300 m were destroyed and 1800 were badly damaged. Windows were broken at 600 m and missiles were thrown a considerable distance. One cylinder was thrown 1200 m. The emergency plan functioned well in the circumstances. Fatality.

[fire - consequence, storage tanks, damage to equipment, fire - consequence, safety procedures inadequate, injury]

Lessons

1. The high death toll occurred because the housing was too near to the plant. At the time the plant was constructed the area was underdeveloped, but over the years the built-up area had gradually crept up to the site.
 2. The total destruction of the facility occurred because there was a failure of the overall system of protection, which includes layout, emergency isolation and water spray.
 3. One feature which might have averted the disaster is more effective gas detection and emergency isolation. The plant had no gas detector system and, probably as a consequence, emergency isolation was too late.
-

3131 31 October 1984

Source : LLOYDS LIST, 1984, 2 NOV.

Location : San Francisco, USA

Injured : 3 Dead : 1

Abstract

A marine transportation incident. A severe explosion, followed by others, badly damaged a bulk LPG carrier (35240 tonnes dwt, 12320 cum. capacity) whilst she was making her way from an oil refinery in the bay, with refined oil products. The vessel later broke in half, in severe weather, after drifting for several days. The parts of the vessel were taken in tow by tugs, and fires extinguished, subsequently being removed from shipping lanes.

The incident produced the largest hull insurance loss for 1984, as well as the loss of life and injury, and some limited environmental damage.

[weather effects, heavy seas, fatality, injury]

Lessons

[None Reported]

9241 15 October 1984

Source : LLOYDS LIST, 1984, OCT, 17.

Location : ,

Injured : 0 Dead : 0

Abstract

A marine transportation incident. An LPG marine tanker carrying 300 tonnes of liquefied petroleum gas collided with a 431 tonne gross marine carrier containing 1,200 tonnes of steel products.

[collision]

Lessons

[None Reported]

3116 06 October 1984

Source : CHEMICAL AND ENGINEERING NEWS, 1984, 15 OCT.; LLOYDS WEEKLY CASUALTY REPORTS, 1984, 23 OCT.

Location : Linden; New Jersey, USA

Injured : 161 Dead : 0

Abstract

A 12,000 gallon tank ruptured at a pesticide plant and released a toxic cloud. More than two dozen crewmembers of a nearby ship were slightly injured when they inhaled the fumes and at least 16 other people reported breathing problems, nausea and skin irritations. The outdoor tank overheated causing a steel cover to blow off. The contained malathion, a commonly used pesticide described as extremely dangerous when inhaled in its pure form. Residents in a 20 mile radius were advised to stay indoors with windows shut until the chemical dissipated. The leak was plugged half an hour after the incident occurred.

[storage tanks, overheating, gas / vapour release, injury]

Lessons

[None Reported]

9240 05 September 1984

Source : LLOYDS LIST, 1984, SEP, 6.

Location :

Injured : 0 Dead : 0

Abstract

A marine transportation incident. An LPG marine tanker ran aground on a sand bank. The vessel was refloated with the aid of a tug.
[ship ran aground]

Lessons

[None Reported]

Source : ICHEME

Location : , WEST GERMANY

Injured : 0 Dead : 0

Abstract

Lightning caused explosion in 4000 cum (cubic metres) isopropyl alcohol storage tank causing the roof to rupture at the weak seam. Tank finally burned down. Shock waves damaged windows up to 800 m away. There was no evidence of a lightning strike on the tank but there was on a chimney lightning conductor 60 m away. It was believed that the chimney strike induced a charge in a temperature measuring device which discharged to earth.
[storage tanks, damage to equipment]

Lessons

The following recommendation swere made:

1. Unused temperature measuring devices were dismantled.
 2. So far temperature measuring devices of that kind are still needed, they have to be checked in installed state. A safe state has to be guaranteed by frequent maintenance work.
 3. The earthing of floats and suspension baskets of such measuring devices has to be checked carefully.
 4. Shorter distances than 50mm between measuring cables and neighbouring steel parts have to be avoided by periodical checking.
 5. Flanges of pipelines have to be checked periodically on sufficient low electrical resistance.
-

Source : LOSS PREVENTION BULLETIN, 073, 9.

Location : ,

Injured : 0 Dead : 0

Abstract

During a thunderstorm, an explosion occurred in a storage tank with a capacity of 10,000 m³ (2.2 m gals), but filled at that time with approximately 4,000 m³ of isopropyl alcohol. The roof of the tank was torn off at the weak welded seam between the roof and the wall.

It was reported that 5 to 15 seconds after a lightning strike, which was immediately followed by a thunderclap, a pop like a detonation could be heard. The roof was blown off and the tank was burning immediately. The fire was extinguished after 26 hours. The damage to equipment was considerable, not only on the site, but also on houses in the surrounding area.

About 60 m away from the tank was a 70 m high chimney with a periodically checked lightning protector. This chimney showed trails of a lightning strike by severe damage of the brick work.

[fire - consequence, storage tanks]

Lessons

[None Reported]

3058 27 July 1984

Source : LLOYDS LIST, 1984, 30 JUL.

Location : Nazareth, Philadelphia, USA

Injured : 3 **Dead** : 1

Abstract

A chemical explosion occurred on a rural plant, causing a fire which raged for hours.

The incident occurred when storage tanks containing isopropyl alcohol exploded, starting a fire, which was fed by flammable gases. A residents were evacuated within a one mile area surrounding the plant. The plant was a total loss.

[fire - consequence, storage tanks, fatality]

Lessons

[None Reported]

9243 July 1984

Source : LLOYDS LIST, 1984, JUL, 11.

Location : ,

Injured : 0 Dead : 0

Abstract

A marine transportation incident. Damage occurred to an LPG marine tanker which was caused by heavy weather.
[weather effects, damage to equipment]

Lessons

[None Reported]

3021 09 June 1984

Source : HAZARDOUS MATERIALS INTELLIGENCE REPORT, 1984, 22 JUN. UNITED PRESS INTERNATIONAL, 1984, JUNE, 10.

Location : Ontario, CANADA

Injured : 0 Dead : 0

Abstract

A rail transportation incident. A fire occurred on a freight train which derailed and forced the evacuation of about 300 people. The incident occurred when the freight train carrying 75 tonnes of light oil went off the tracks and caught fire at one point an empty propane car exploded setting fire to four other empty cars, fortunately causing no injuries. The blast shattered windows in the area. Firefighters built a dike around the derailed car to contain the oil.
[explosion]

Lessons

[None Reported]

2985 30 April 1984

Source : HAZARDOUS CARGO BULLETIN, 1984, NOV.

Location : Manaus, BRAZIL

Injured : 0 Dead : 0

Abstract

A marine transportation incident. Fire in pump room of marine tanker when offloading kerosene due to rupture of flexible coupling. A spark from the pump ignited the leaking cargo.

[coupling failure]

Lessons

[None Reported]

2980 20 April 1984

Source : LENOIR E.M & DAVENPORT J.A, A SURVEY OF VAPOUR CLOUD EXPLOSIONS SECOND UPDATE, PROCESS SAFETY PROGRESS, 1993, 12, (1), 12-33.; TORONTO GLOBE & MAIL, 1984, 24 APR.

Location : Sarnia; Ontario, CANADA

Injured : 2 **Dead :** 2

Abstract

Explosion at styrene plant during startup. A manhead flange failed in a light oil hydrogenation unit releasing 30 kg of hydrogen in a compressor shed. Ignition occurred in 10 to 15 secs. Significant damage to building and structures. Window damage to 365 m. Start-up. Fatality.
[flange failure, damage to equipment]

Lessons

[None Reported]

9246 21 March 1984

Source : LLOYDS LIST, 1984, MAR, 23, 26.

Location : ,

Injured : 0 Dead : 0

Abstract

A marine transportation incident. An LPG marine tanker sustained severe damage to the bow which was caused by a collision with an unidentified ship.
[damage to equipment]

Lessons

[None Reported]

2940 08 March 1984

Source : LOSS PREVENTION BULLETIN, 106, 9-13; LLOYDS LIST, 1984, 9 MAR.; 100 LARGEST LOSSES, 9TH EDITION, MARSH & MCLENNAN PROTECTION CONSULTANTS, 1986. LOSS PREVENTION IN THE PROCESS INDUSTRIES, PAGE 2-5.

Location : , INDIA

Injured : 0 **Dead :** 4

Abstract

This incident occurred in a fuel refinery commissioned in 1966. It is believed that light ends from a leak in a heat exchanger entered the return cooling water lines and travelled to the cooling towers where they were released. Ignition was probably from the adjoining utility plant. The explosion occurred involving storage tanks subsequently causing a fire. The explosion was heard and felt two kilometres away. Refinery personnel who went to the site immediately and reported that three tanks, two containing naphtha and the other containing aviation fuel were involved in the fire.

Fire fighting operations were made difficult because naphtha from one of the tanks had spilled through a damaged pipeline into the dyke which was on fire.

Another tank developed a leak in the bottom and its contents were spilling into the dyke. As cooling water to the tanks was being applied in larger quantities than could be drained out, water levels in dykes continued to rise. In fact pumps had to be used to dewater the dykes.

The damage to the property inside the refinery was spread over a large area. The utilities area, the chemical warehouse and three storage tanks were damaged by the explosion and fire.

[fire - consequence, refining, fatality, burns]

Lessons

[None Reported]

2933 March 1984

Source : ICHEME

Location : , NIGERIA

Injured : 0 Dead : 10

Abstract

Kerosene explosions on a refinery. Fatality.

[refining]

Lessons

[None Reported]

Source : LLOYDS LIST, 1984, MAR, 23.

Location : ,

Injured : 0 Dead : 0

Abstract

A marine transportation incident. An LPG marine tanker sustained damage to the bow when in collision with another ship.
[damage to equipment]

Lessons

[None Reported]

2928 27 February 1984

Source : LLOYDS LIST, 1984, 1 MAR.

Location : Mississauga; Ontario, CANADA

Injured : 0 Dead : 0

Abstract

Fire occurred in a large pump of a plant for lubricating oil.

[fire - consequence]

Lessons

[None Reported]

9247 08 February 1984

Source : LLOYDS LIST, 1984, FEB, 22.

Location :

Injured : 0 Dead : 0

Abstract

A marine transportation incident. A fire broke out inside the main engine scavenging manifold on a LPG marine tanker, damaging the main engine.
[fire - consequence, damage to equipment]

Lessons

[None Reported]

2900 26 January 1984

Source : FINANCIAL TIMES, 1984, 27 JAN.; LEICESTER MERCURY, 1984, 27 JAN. SAFETY FIRE NEWS, 1984, SEP.

Location : Desford; Leicester, UK

Injured : 5 **Dead :** 0

Abstract

A release of LPG from a portable gas cylinder filling plant caused an explosion and fire. The explosion occurred when a pick-up truck was started up near to a shed where 50 cylinders were being filled with gas.

After investigations it was found that the cylinders were initially charged with excessive quantities of liquefied propane prior to air being vented, excessive numbers of cylinders were vented simultaneously, venting of the air was not carried out in a safe place and that all sources of ignition were not excluded from the area during venting.

[fire - consequence]

Lessons

[None Reported]

2872 02 January 1984

Source : DAILY TELEGRAPH, 1984, 3 JAN.

Location : Scunthorpe, UK

Injured : 2 Dead : 2

Abstract

An entry into confined space incident.

A man dropped his torch into a tank and went to retrieve it. He got into difficulties, three people tried to assist. Two people were found dead due to asphyxiation.

The tank was used to store recycled water. Investigators believe that a hydraulic lubricant - phosphate ester, had combined with water during the production process to give off toxic fumes in the tank. Fatality.

Lessons

[None Reported]

Source : ICHEME

Location : , USA

Injured : 0 **Dead :** 0

Abstract

A vapour cloud explosion occurred at a refinery deisobutaniser plant which was caused by a frozen pipeline. Substance involved: light ends. Source of ignition was vehicle.

[freezing, refining, cold weather]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, 1984, JAN., 23.

Location : Highlands; Texas, USA

Injured : 0 **Dead** : 0

Abstract

Fire in dock warehouse containing drums of jet fuel and ethylene glycol. Incident led to the evacuation of 2,000 residents. The fire destroyed a large administration building and a seven-acre tract of land occupied by storage warehouses. During clean up operations it was noticed that ethylene glycol and lube oil were seeping down into a nearby gully. Although floating booms were deployed and vacuum trucks brought in to suck up the debris, these measures were not 100 percent effective.

[fire - consequence, warehousing, spill]

Lessons

[None Reported]

2822 December 1983

Source : ICHEME

Location : , KUWAIT

Injured : 0 Dead : 0

Abstract

An explosion occurred on a column at a refinery LPG plant.

[terrorism, refining]

Lessons

[None Reported]

Source : SEDGWICK LOSS CONTROL NEWSLETTER

Location : , KUWAIT

Injured : 0 Dead : 0

Abstract

Bomb attack on LPG fractionation column by terrorists. Sabotage.

[terrorism]

Lessons

[None Reported]

2787 02 November 1983

Source : HAZARDOUS CARGO BULLETIN, 1984, JAN.

Location : Dhurabari, INDIA

Injured : 0 **Dead** : 76

Abstract

A rail transportation incident. An explosion occurred on a leaking rail tanker containing kerosene at a station.

[fatality]

Lessons

[None Reported]

2783 31 October 1983

Source : ICHEME

Location : , OMAN

Injured : 0 Dead : 0

Abstract

A weld failure caused a fire at a production pump station. Source of ignition was hot surface. Substance involved: lube oil.

[fire - consequence]

Lessons

[None Reported]

2776 21 October 1983

Source : ICHEME

Location : , INDIA

Injured : 0 Dead : 0

Abstract

Fire at a petrochemical steam cracker plant involving a compressor and lube oil which was caused by seal failure. Source of ignition was hot surface.
[fire - consequence, seal failure, cracking]

Lessons

[None Reported]

2774 20 October 1983

Source : INSTITUTE OF INSURERS

Location : Kaduna, NIGERIA

Injured : 0 **Dead** : 0

Abstract

Overheating of gearbox caused sparks and ignition of lubricating oil.

Lessons

[None Reported]

2755 04 October 1983

Source : LLOYDS LIST, 1983, 31 OCT.

Location : Port Of Spain, TRINIDAD

Injured : 6 **Dead :** 1

Abstract

Leak of LPG from tank lead to explosion. Fatality

Lessons

[None Reported]

2723 13 September 1983

Source : INSTITUTE OF INSURERS

Location : Marino Point, IRELAND

Injured : 0 **Dead** : 0

Abstract

Lagging fire in compressor house involving lubricating oil.

[fire - consequence]

Lessons

[None Reported]

2712 02 September 1983

Source : HAZARDOUS MATERIALS INTELLIGENCE REPORT, 1983, 16 SEP.

Location : Murdock, Illinois, USA

Injured : 0 **Dead** : 0

Abstract

A rail transportation incident. Derailment of rail tankers caused spillage of sulphuric acid, ethanol, propane and isobutane, which caught fire.
[fire - consequence]

Lessons

[None Reported]

2631 15 June 1983

Source : DAILY TELEGRAPH, 1983, 17 JUN.

Location : Nacogdoches, USA

Injured : 100+ **Dead** : 0

Abstract

More than 100 people were overcome by fumes when a dense 100 yard wide cloud of insecticide leaked from a greenhouse at a university. Approximately 1,500 people were evacuated. The cloud of the chemical, parathion, caused many people to suffer eye and nose irritation. [gas / vapour release, evacuation]

Lessons

The chemical parathion is highly toxic by skin contact, inhalation or swallowing.

Source : HAZARDOUS CARGO BULLETIN, JULY 1983.

Location : , USA

Injured : 0 Dead : 0

Abstract

A road transportation incident. Approximately 1,000 fish were killed when a tank truck carrying a mixed load, including insecticide, heating oil and jet helicopter fuel when its brakes failed causing the tanker to overturn.

Clean-up crews spread lime to neutralize the spilt insecticide.

[ecological damage, brakes faulty, spill]

Lessons

[None Reported]

2601 15 May 1983

Source : INSTITUTE OF INSURERS

Location : New Delhi, INDIA

Injured : 0 **Dead** : 0

Abstract

Fire at LPG bottling plant.

[fire - consequence]

Lessons

[None Reported]

2569 14 April 1983

Source : LLOYDS LIST, 1983, 16 APR.

Location : Kalimantan, INDONESIA

Injured : 40 **Dead** : 3

Abstract

Explosion at LPG plant. Due to excessive pressure a cryogenic heat exchanger ruptured during start-up operations after tie in operations valve on main blow down header was not opened. Fatality.
[cryogenic equipment]

Lessons

[None Reported]

2532 15 March 1983

Source : PIPELINE ACCIDENT REPORT MID-AMERICA PIPELINE SYSTEM LIQUEFIED PETROLEUM GAS PIPELINE SYSTEM, NATIONAL TRANSPORTATION SAFETY BOARD, WASHINGTON D.C, USA, REPORT NUMBER NTSB-PAR-84-1, 1984.

Location : West Odessa; Texas, USA

Injured : 5 **Dead :** 5

Abstract

An 8 inch diameter LPG pipeline was damaged by a rotating drill used to drill holes for tree planting. The pipeline ruptured, LPG escaped and was ignited. The probable cause was the reduction in pipe wall thickness and failure of the operator to recognise the presence of the pipeline. Fatality. Explosion and fire. Leak.

[fire - consequence, damage to equipment]

Lessons

[None Reported]

2514 24 February 1983

Source : INSTITUTE OF INSURERS

Location : Marino Point, IRELAND

Injured : 0 Dead : 0

Abstract

A pump feeding lubricating oil to a turbine failed and escaping oil ignited. Spill.

[fire - consequence]

Lessons

[None Reported]

2513 18 February 1983

Source : ICHEME

Location : , VENEZUELA

Injured : 16 Dead : 4

Abstract

A steam boiler designed to produce 1430 tonnes of steam per hour and testing of the mechanical and electrical equipment had been completed. The control and firing was undergoing tests when a violent explosion occurred. The explosion was attributed to some LPG used for igniting the burner leaking into the boiler and being ignited by the igniter system being tested. It was probably the largest boiler in the world. Fatality.

Lessons

[None Reported]

2507 09 February 1983

Source : ICHEME

Location : , USA

Injured : 0 Dead : 0

Abstract

Explosion in refinery LPG plant.

[refining]

Lessons

[None Reported]

2506 09 February 1983

Source : JOURNAL OF COMMERCE, 1983, 11 FEB.

Location : Detroit, USA

Injured : 8 Dead : 0

Abstract

Explosion in LPG processing unit at refinery.

[refining]

Lessons

[None Reported]

2487 25 January 1983

Source : ICHEME

Location : , OMAN

Injured : 0 Dead : 0

Abstract

A fire occurred at a compressor station involving a pump and lube oil due to a weld failure. Source of ignition was hot surface.

[fire - consequence]

Lessons

[None Reported]

9753 17 January 1983

Source : ICHEME

Location : , PORTUGAL

Injured : 0 Dead : 0

Abstract

A serious fire occurred at an installation, when escaping gas from an LPG line caught fire and destroyed the adjacent canteen causing damage totalling £70,000 (1983). Fortunately the building was empty at the time and there were no casualties.

[fire - consequence, leak, damage to equipment]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A road transportation incident. An LPG road tanker attempted to pass under a bridge of restricted height. While the driver stopped and checked to ensure that he could pass he failed to take into account the accessories projecting at the upper end of the tank, a ladder and slip-tube gauges. As a result the gauge flanges were broken and a small quantity of LPG vapour escape. The tanker was almost empty and there was, therefore, no real danger from this leakage but, if the tank had been full, the danger would have been substantially increased due to the leakage of liquefied gas.

[Near miss, human causes]

Lessons

[None Reported]

2468 04 January 1983

Source : INSTITUTE OF INSURERS

Location : Athens, GREECE

Injured : 0 **Dead** : 0

Abstract

Error in setting of valves resulted in mixing of product. Substances involved: LPG, hydrogen sulphide and gas oil.
[mixing, human causes]

Lessons

[None Reported]

Source : SAFETY PRACTITIONER, 1983, DEC, 28-29.

Location : , UK

Injured : 0 Dead : 3

Abstract

During cleaning of oil storage tanks an explosion occurred which ruptured the roof of the tank. Kerosene was being used to clean the tank. The source of the ignition could have been a non-flameproof floodlight or static generated on either the clothing being worn or on the hose pipe used. Fatality.
[cleaning]

Lessons

[None Reported]

2452 1983

Source : NFPA REPORT

Location : Maryland, USA

Injured : 0 **Dead :** 0

Abstract

A road transportation incident. 2000 usg of kerosene spilt from a road tanker but no ignition occurred.

[spill]

Lessons

[None Reported]

Source : ICHEME

Location : , ITALY

Injured : 30 Dead : 6

Abstract

A road transportation incident. Six people died and 30 people injured when fog caused a series of clashes on the motorway including a road tanker which caught fire. A road tanker transporting LPG was involved in a crash with two cars while another two cars came up behind it and crashed into it. The petrol tank of one tanker exploded and the gas contained in the tanker exploded. Many hours after the explosion which destroyed the prime mover of the tanker, the flames passed to the trailer and the second part of the liquid gas burnt slowly. There was still a risk of a second explosion so the safety distance was 100 metres. The explosion was preceded by a fire. Once the trailer had melted, the fire brigade was able to move in.

[fire - consequence, fatality, injury]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, JANUARY 1983, VOL:4 NO:1

Location : Houston, USA

Injured : 3 Dead : 0

Abstract

A tank truck containing 9,000 gallons of liquefied propane caught fire at a LPG loading bay injuring three workers. The driver of the truck suffered second degree burns.

The fire was extinguished in just over an hour. No explosion occurred.

The cause of the incident is under investigation.

[road tanker, fire - consequence, injury]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A release of reactor product resulted from a failure of a non-return valve on a plant. The cause of the incident was the failure of the hinge pin seals on a 25mm zirconium non-return valve due to the use of incorrect gasket material. The non-return valve is an acid purge line feeding the reactor start-up loop.

It is estimated that about 100kg of acid material containing iodine compounds, out of a total inventory at the time of the incident of 41,000kg, was lost to atmosphere.

Dilution to concentrations below the emergency exposure limit occurred within 20 meters downwind of the reactor and did not extend beyond the plot limit.

There were no injuries to personnel.

The reactor was emptied of liquid in one hour and depressurised in a further three and a half hours.

The cause of the incident was incorrect gasket material in the hinge pin seals on a 25mm zirconium non-stop valve in an acid purge line feeding the reactor start-up loop. The failure of the gasket material led to the release of reactor product.

[reactors and reaction equipment, valve failure, spill, gas / vapour release]

Lessons

All valves similar to the one that failed to be examined and steps taken to prevent a recurrence.

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A 3,500 cubic metre refrigerated LPG carrier was part way through its loading programme when the emergency release systems, installed at the jetty loading arm, parted without any initiating action having taken place and with the double ball valves open. A release of refrigerated butane occurred which was only stopped by the manual activation of the jetty shutdown system and closure of the ship's manifold isolation valves. The jetty head firewater monitors were switched on and the vapour cloud which had formed dispersed without incident in about 10 minutes. No injuries were reported.

An investigation into the incident concluded that the hydraulic sequence valve had been passing thus admitting hydraulic oil pressure to the emergency release system (ERS) coupling actuator when the ball valves were opened. However, in order to allow sufficient pressure to build up to cause the (ERS) coupling to release it was necessary for a bleed off facility, designed to prevent such an occurrence, to become inoperable. Subsequent examination revealed that a non-return valve had been fitted into the bleed off system in error and in such a way that no flow back into the bleed off system in error and in such a way that no flow back to drain was possible in the bleed off line.

[refrigeration unit, gas / vapour release, installation inadequate, marine tanker]

Lessons

[None Reported]

1000901 August 1982

Source : ICHEME

Location : , TANZANIA

Injured : 19 Dead : 71

Abstract

An LPG explosion occurred which left 71 people dead and 19 seriously injured. The accident took place at a textile factory which used LPG from two skid mounted tanks.

It was believed that an electrical fire occurred in the works area and, as a safety precaution, the factory engineer had one of the tanks disconnected and towed away to a safe area. The other tank was empty at this time. After the fire had been successfully extinguished the engineer decided to move the tank back into position. On this occasion it proved too heavy and he decided to lighten it by venting the contents to atmosphere. A cloud of gas drifted towards a restaurant some 30 yards away where it was ignited by a cooking fire and a violent explosion occurred.

[LPG, fatality, competency lacking, operator error, vapour cloud explosion, gas / vapour release, hot surface, injury]

Lessons

This accident was caused by a lack of knowledge about the characteristics and physical properties of LPG on the part of the factory engineer.

2365 19 May 1982

Source : ENVIRONMENTAL EMERGENCIES. A REVIEW OF EMERGENCIES AND DISASTERS INVOLVING HAZARDOUS SUBSTANCES OVER THE PAST TEN YEARS. VOLUME 2. UNCUEA

Location : , BRAZIL

Injured : 0 **Dead :** 0

Abstract

Storage reservoir of metal factory containing toxic waste material ruptured. Polluted sludge, zinc, cadmium, lead and mercury spilt into river, washed down river for 400 km. Dead fish and animals found. Drinking water reservoirs polluted. 400000 people lost their drinking water for 2 weeks.

[spill, pollution]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A quantity of isobutane and polyethylene powder was inadvertently discharged to atmosphere through an open vent valve on the No.3 settling leg of No.4 loop when the actuating air lines were reconnected to the 200mm shut off valve and the valve moved to the open position. The open vent valve was quickly closed by the foreman with no adverse effect.

The incident occurred because of a malfunction in a solenoid valve in the air control system of the settling leg shut-off valve. However, the air lines to the shut-off valve would not have been reconnected at all if the instructions laid down in the factory permit to work procedures had been followed. In addition, the escape would no have occurred if the operating instruction had been followed.

[gas / vapour release, design or procedure error]

Lessons

[None Reported]

1055922 March 1982

Source : HAZARDOUS MATERIALS INTELLIGENCE REPORT, APR 2, 1982.

Location : Missouri, USA

Injured : 6 Dead : 0

Abstract

A fire of undetermined cause destroyed a janitorial supply company. The building contained up to 300 different kinds of chemicals, including muriatic acid, trichloroethane and isobutyl alcohol. Six firefighters were treated for acid burns. Clean-up would involve removal of 50 drums of chemicals buried under two metres of firefighting water and rubble in the basement. The drums were believed to be intact, as water pumped from the basement did not contain detectable levels of contamination.

[fire - consequence, spill, storage]

Lessons

[None Reported]

Source : ICHEME

Location : , WEST AFRICA

Injured : 0 Dead : 4

Abstract

An emergency generator at a petroleum terminal was brought on line. When the diesel generator was running satisfactorily, the 4 staff left the room and entered the adjacent switch house, it is believed with the intention of bringing the generator on line. An explosion occurred and all four were killed. The LPG system consisted of 4 inch jetty line to two large spheres. The entry line passed close to the emergency generator before entering a banded pipe trench. As a heavy vehicle was to be used for pile driving in the area it had been decided to depressurise and degas the line between the spheres and the first valve, the spheres themselves, the bulk loading line and the bottle filling line. This venting took place without supervision and no readings were taken to monitor gas concentrations. This work was done without a permit to work, as was normal when work was carried out by the company's own staff. The accident took place 8 hours after the venting.

After the accident investigations showed evidence of physical damage, but no evidence of secondary fires. It was concluded that the fire involved LPG only. No other work was taking place, nor were there any other people in the area, suggesting that the ignition source came from the generator itself. The most likely cause was spark from the non-flameproof switch when it was moved from mains to emergency power. The gas was stenching so it is unclear why the staff did not notice the smell in the area. Several possible mechanisms were identified for gas to escape from the open end of the gas line, but none can be definitely confirmed as the cause of the accident.

[fatality]

Lessons

The following areas were identified to prevent reoccurrence of such an event:

1. Better control of hazardous work.
 2. Improved training and knowledge of the hazards of working with LP gas.
-

2282 20 November 1981

Source : ICHEME

Location : , TRINIDAD

Injured : 0 Dead : 0

Abstract

A fire at a refinery plant involving a furnace and kerosene caused by a tube failure.

[fire - consequence, refining]

Lessons

[None Reported]

7393 13 October 1981

Source : LOSS PREVENTION BULLETIN, 054, 33.

Location : Koshoba, Yokohama, JAPAN

Injured : 2 **Dead** : 0

Abstract

An explosion in an underground storage tank containing jet fuel led to the evacuation of nearby residents. 153,000 barrels of jet fuel was stored in the tank at the time of the explosion.

Lessons

[None Reported]

2260 27 September 1981

Source : PIPELINE ACCIDENT REPORT, NATIONAL TRANSPORTATION SAFETY BOARD, WASHINGTON D.C, USA, REPORT NUMBER, NTSB PAR-82-2, 1982.

Location : Ackerly; Texas, USA

Injured : 0 **Dead** : 4

Abstract

A refined petroleum 12 inch pipeline was damaged by a drilling machine. The wall of the pipeline was damaged and ruptured under the 1100 psig pressure. The LPG mixture, ethane and propane, escaped and was ignited by the drilling rig engine. The oil company failed to determine the existence of the pipeline before drilling operations began. Leak. Fatality.

[fire - consequence, refining, drill, design or procedure error]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

An incident occurred at an installation consisting of two 12 tonne LPG tanks with vapour take-off, providing gas to ovens in a factory. The inlet, vapour and drain connections were grouped together under tanks and cross-connected on manifolds. Each vapour line had a T-connection, one branch of which was connected to the factory gas supply and the other to a pipe terminating in a valve and thread hose connection which allowed for vapour return during filling. The liquid filling line terminated alongside the vapour return line with a similar valve and threaded hose connection. These pipes and valves were not labelled or identified in any way.

The incident occurred when the delivery hose from the tanker was connected to the vapour return coupling. Had this pipe been solely a vapour return line from the tank, the liquid would have simply entered the tank via the vapour space rather than by the normal submerged liquid line but, because the vapour return line had a connecting branch leading to the factory, liquid LPG was able to reach the ovens causing the burners to flare up.

[operation inadequate, backflow, gas / vapour release]

Lessons

Such incidents can be avoided if:

1. Unused vapour return lines are blanked off.
 2. Vapour return lines in regular use are separated from vapour off-take lines.
 3. Pipes and valves are clearly marked to distinguish gas from liquid and inlet from outlet, etc.
-

2239 August 1981

Source : ICHEME

Location : , GERMANY

Injured : 0 Dead : 0

Abstract

Vapour cloud explosion at a refinery stabiliser involving a valve and LPG, cause, freezing. Source of ignition was furnace.
[refining, cold weather]

Lessons

[None Reported]

Source : ICHEME

Location : , NIGERIA

Injured : 0 **Dead :** 0

Abstract

An explosion at a refinery plant involving a compressor and LPG.

[refining]

Lessons

[None Reported]

Source : ICHEME

Location : , KOREA SOUTH

Injured : 0 **Dead :** 0

Abstract

Fire at a refinery lube oil plant involving the air cooler. Source of ignition was static, caused by tube failure.

[fire - consequence, refining]

Lessons

[None Reported]

2203 26 May 1981

Source : LLOYDS LIST, 1981, 29 MAY; HAZARDOUS MATERIALS INTELLIGENCE REPORT, 1981, 5 JUN.

Location : Artesia, NEW MEXICO

Injured : 16 Dead : 1

Abstract

Explosion and fire caused extensive damage to catalytic cracking unit when propane and butane gas leaked from a pump which was being repaired. Resulting fireball was 600 ft in diameter. LPG. Fatality.
[fire - consequence, catalytic cracker, repair]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 054, 26.

Location : , HOLLAND

Injured : 2 **Dead** : 0

Abstract

An explosion and fire damaged a new liquefied petroleum gas (LPG) carrier. The fire was not connected with the gas tanks.

[fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 1 Dead : 0

Abstract

On opening a difficultly located drain valve on a transfer line, there was no flow due to blockage by ice; further opening of the drain valve allowed a sudden release of isobutane which ignited causing minor injuries to the operator.

[freezing, fire - consequence, leak, material transfer, injury]

Lessons

Drain valves which can ice-up need to be located so that they can be easily operated, and unblocked safely.

9408 16 April 1981

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

Attempts to drain water from a rundown line between the purge vent knock out and the vapour recovery tower when there was a sudden release of isobutane at the drain valve which flashed and ignited. Once the initial flash occurred, smaller fires burned at the drain valve and on the lagging in the immediate vicinity. The operator who was attempting to drain the rundown line received burns to his face and right hand.

It was concluded that the sudden release of isobutane occurred as a result of an ice blockage at the drain valve clearing, just after the drain valve had been partially opened. In addition, access to the drain valve is very restrictive.

All electrical equipment in the vicinity of the incident has been checked and found to be earthed properly. A temperature survey carried out did not reveal any hot surface which approached the required auto-ignition temperature. Static discharge must have been the source of ignition.

[fire - consequence, leak]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 1 Dead : 0

Abstract

A small fire/explosion occurred at a refinery during the bottom loading of a road vehicle. The vehicle had returned to the refinery after previously delivering motor spirit and was being loaded with dual purpose kerosene through a 3 inch hose connection. The driver commenced loading the largest tank, following the correct procedure (earthing etc). Loading was under the control of an initial slow start system for the first 30 seconds. The compartment was approximately half full when a small explosion occurred in the compartment, flames appeared at the top man lid which was open at the time.

The driver was slightly burned and only minor damage was done to the vehicle.

[road tanker, loading/unloading, motor spirit, petroleum spirit, kerosene, explosion, fire - consequence, burns, damage to equipment]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

Four tanks, each comprising an inner tank resting on a concrete ring within an outer insulated tank, were filled for pre-stressing.

The procedure adopted was to fill the inner tanks of one pair of tanks from the refinery, equalise levels in the outer and inner tanks, and then top up both inner tanks and annular spaces together.

The material was then transferred to the other pair of tanks and the procedure repeated.

Towards the end of the operation it was discovered that there was a leak between the outer and inner tanks of one of the LPG tanks. Subsequently it was found that the bottom of the inner tank resembled an embossed cruciform, and the shell was buckled and torn.

[material transfer, damage to equipment]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A small ethylene leak was discovered coming from a coupling joint on lubricating oil pipework on an intensifier on a high density polyethylene plant.

The equipment was shutdown and the coupling leak repaired.

No-body was injured in the incident.

An investigation into this incident concluded that the leak had been caused by excessive vibration which had loosened the coupling.

Following a study of the installation, one additional pipe support was installed on the pipework.

[separation, environmental]

Lessons

Excessive pipework vibration can result in a serious incident.

Source : HAZARDOUS CARGO BULLETIN, JANUARY 1981, PAGE 23.

Location :

Injured : 0 Dead : 0

Abstract

A marine transportation incident. Two marine tankers were in collision with each other resulting in minor damage to both ships, no injuries were reported. One tanker received damage to a port tank resulting in a spillage of aviation kerosene.
[damage to equipment]

Lessons

[None Reported]

Source : ICHEME**Location :** , UK**Injured :** 0 **Dead :** 0

Abstract

A vessel had been charged with two batches of latex to which had been added the normal plasticiser, soaps, stabiliser (ammonia) and chelating agent. Heat up was commenced in accordance with the normal procedure using steam to the vessel jacket. When the vessel contents reached the appropriate temperature (65 degrees C), the steam supply to the jacket was removed. The vessel heating to 65 degrees C had taken slightly longer than normal but not sufficiently different to give any cause for concern. Steam was injected into the vessel via a bottom sparge line with the intent of raising the temperature to 125 degrees C at a rate of 1 degree C every 2 minutes.

It was not possible to achieve the normal heating rate but the previous three charges had similar problems. After about 3.5 hours the temperature had reached 90 degrees C at which point the vessel vent was closed as normal practice. After a further 6.5 hours the temperature had only reached 113 degrees C and was rising at only 1 degree C every 30 minutes. Heating was continued for a further 6.5 hours by which time the temperature had reached 120 degrees C and the decision was made to abandon heating. After a further hour, vessel cooling commenced.

Normally cooling from 125 degrees C to 30 degrees C took between 12 and 14 hours. After 26 hours cooling the temperature had only fallen to 72 degrees C. The operator tried to transfer the vessel contents but found that the transfer lines were blocked. The supervisor decide to apply additional cooling to the dome of the vessel by means of water hoses and to evacuate the area while the vessel was allowed to cool. After 28 hours additional cooling when the vessel had reached 50 degrees C, it was decided to vent the vessel by loosening the manlid bolts. Initially gas was released followed by a mixture of gas and liquid until the vessel was fully vented.

The next day, the manlid was removed and the vessel was found to be full of solid material with the general level being about 12 inches below the manlid.

There were high spots on the surface corresponding to each of the nozzles on the vessel dome that indicated that the vessel had been completely filled until the solid had contracted on cooling.

A detailed investigation, including pilot scale trials, was carried out to identify the cause of gelation.

The reduced heating rate was attributed to the steam supply having been recently reduced from 80 psig to 50 psig. The cause of gelation was considered due to a combination of a lower than usual ammonia content with reduced pH and the extended period of time for which the contents were at an elevated temperature.

[heating, normal operations, evacuation, gas / vapour release, container]

Lessons

It was difficult to foresee the occurrence of gelation as the charge conditions were close to normal and it was only the coincident reduction in steam supply that led to the problem.

The investigation team recommended restoring the steam sparge supply to 80 psig, providing steam flow indication and modifying the sparge line to minimise the potential for blockage. These measures were designed to ensure that an adequate heating rate could be maintained.

The team further recommended investigating means of reducing ammonia loss and seeking advice from R&DD on ammonia contents to improve stability.

The final recommendation was to develop contingency plans to deal with abnormalities observed during processing.

2056 15 September 1980

Source : FIRE PREVENTION, 1981, APR.

Location : San Fernando, TRINADAD

Injured : 3 **Dead** : 0

Abstract

Fire destroyed LPG filling plant and an adjacent 2 storey residential building. Plant's automatic filler short circuited.

[fire - consequence, filling machine]

Lessons

[None Reported]

Source : ICHEME

Location : , USA

Injured : 0 Dead : 0

Abstract

A road transportation incident. A tank truck carrying 9000 gallons of LPG (liquefied propane gas) began leaking through a pressure relief valve while travelling over a bridge. The driver learned of the leak by radio from another trucker on the bridge and continued across the bridge to an exit ramp where he stopped the vehicle.

The fire department arrived quickly and stopped traffic on the 2 level bridge for about 6 hours, while response personnel worked to cap the leak and to prevent the tank and the leaking gas from igniting and exploding.

[near miss]

Lessons

[None Reported]

2014 09 May 1980

Source : ICHEME

Location : , SPAIN

Injured : 0 Dead : 0

Abstract

A fire at a refinery desulphuriser plant. Source of ignition was furnace involving kerosene.

[fire - consequence, refining]

Lessons

[None Reported]

2009 01 May 1980

Source : ICHEME

Location : , TURKEY

Injured : 0 Dead : 0

Abstract

An explosion occurred at a refinery LPG and natural gas liquids (NGL) plant.

[fire - consequence, refining]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 037, 24-25.

Location : ,

Injured : 0 Dead : 0

Abstract

On the evening of the incident, large quantities of white powder were observed in the area of two lime silos. It was apparent that the chute along the bottom of the one of the silos had become detached due to the bolts along one side being sheared. The sloping side walls at the bottom of the silo had then bulged outwards and allowed some 30 tonnes of lime to spill to the ground.

The following conclusions were drawn after investigation of the incident:

1. The failure of the silo was most probably caused by the blockage of the filter bags which resulted in the build up of an internal pressure from the fluidising air. The failure may have been initiated by failure of the cross brace welds.
2. The silos were under-designed by present day standards and were not classed as pressure vessels at the time of the incident.
3. The silos were loaded above their design capacity of 30 tonnes and the method of assessing lime level was inaccurate.
4. The filter bags were difficult to clean and would block unless cleaned frequently.

[silo/hopper, high pressure]

Lessons

The following recommendations were made:

1. The silos to be re-designed to current standards and assessed as pressure vessels.
 2. An improved filter system to be provided which includes equipment to monitor the efficiency of the filters.
 3. A high level alarm to be fitted to prevent overloading.
 4. Action to be taken to prevent unauthorised resetting of relief and reducing valves.
-

1991 06 March 1980

Source : NATIONAL TRANSPORTATION SAFETY BOARD, WASHINGTON D.C, USA, NTSB-PAR-81-2;NTSB-HZM MAP-80-6. ENVIRONMENTAL PROTECTION BULLETIN, 035, 18-19.

Location : Manassas And Locust Grove; Virginia, USA

Injured : 0 **Dead** : 0

Abstract

A pressure surge in a major pipeline carrying oil products occurred causing it to rupture in two separate places, releasing a total of about 1600 m3 of kerosene and fuel oil. The release caused extensive pollution of two river systems, killing wildlife and posing serious threats to the drinking water supplies of substantial numbers of people.

The failed pipe from both locations was sent for inspection, testing and analysis. Inspection of the section of pipe that ruptured under a road indicated that failure occurred near the bottom of the pipe where it had been thinned from ground water leakage from past the pipe-to-casing seal into the annular space between pipe and casing, where the water could create a corrosion cell and the shielding effect of the casing would mitigate against adequate cathodic protection.

It was reported that corrosion resulting from damaged coating on carrier pipe inside its casing was, unfortunately, common in pipeline systems. An electrical shorting of the pipe can occur when the pipe coating has been damaged and the separators that position the pipe away from the casing have been broken. If water enters the casing, cathodic protection cannot adequately protect the pipe under these conditions.

After the incident the company was requested to survey every point where the pipe was installed inside the casing. There were over 2500 road or rail crossings where casing was used, of which 277 (11%) were found to be shorted or partially shorted electrically. These 277 locations were considered to be areas where corrosion could occur and the company initiated a programme to either repair or replace the pipe at these positions.

[transportation]

Lessons

[None Reported]

1983 11 February 1980

Source : THE FIRE AND EXPLOSION..., HSE REPORT, 1981, ISBN 0717600734.

Location : Longport; Stoke On Trent; Staffordshire, UK

Injured : 3 Dead : 0

Abstract

Fire and series of explosions occurred at a warehouse containing LPG in cartridges and aerosol containers as well as petroleum mixtures in small containers. The probable source of ignition was the electrical system of a battery operated fork lift truck. The origin of the flammable atmosphere was not identified. [warehousing, electrical equipment failure]

Lessons

LPG is a well known fire and explosion hazard; the circumstances of the fire emphasise the need for occupiers of premises containing LPG to be adequately informed, by obtaining information and advice from authoritative sources, on the hazards of LPG and the precautions to be observed in its storage.

The report recommends:

1. Advice should be prepared on the selection of powered lift trucks for use in premises where LPG is stored.
 2. Large stocks of aerosols containing LPG present a major hazard and should be subject to control.
-

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

No. 2 and 3 settling legs on a loop became inoperable. The No.2 leg 80mm valve was passing and had caused a flash tank blockage which had necessitated killing reaction. A blockage was also suspected in the No.3 leg. The next day the No.2 leg 80mm valve was renewed, but the No.3 leg was not checked until the night shift. However, when the settling leg was opened up for inspection, no blockage was found, so the leg was boxed up. The air lines were replaced on all the 200mm and 80mm valves.

Four days later a large cloud of isobutane was vented suddenly from the vent valve on the No.3 settling leg. However the cloud did not ignite and the senior operator was able to close the valve and stop the emission. The factory fire service were called in to stand by. Examination of the system revealed that the vent valves on both No.2 and 3 legs had been left open. These valves are normally used to vent down the settling legs had been opened up by maintenance any diluent present must have entered the leg after this time. Also, since the valve had been used to vent down the legs, there was no evidence of any blockage. Consequently, it is likely that the diluent present in No 3 leg entered the leg suddenly at the time of the incident and is not attributable to the passing of either the 200mm valve or the various 25mm valves on the flush pipework in the area. In addition, at the same time of the incident, the reactor pressure recorded, dropped slightly from 5 bar to 4.7 bar, which would suggest that the diluent came from the reactor, through the 200mm valve. In fact, there had been several reports of unusual occurrences with the 200mm valves on No.4 loop prior to this incident. Consequently the solenoid on the air supply to the shuttle valve on the No.3 leg 200mm valve operating but, when the settling leg was checked, there was no diluent present.

At the present time it is not possible to determine the cause of the emission of isobutane. The evidence pointing to spurious operation of the 200mm is inconclusive, particularly since there exists an interlock which closes the 200mm valves when the reactor pressure drops below 36 bar. Also, examination of the settling leg contents after the reported operation of the valves indicated no isobutane present.

[gas / vapour release, low pressure]

Lessons

To avoid a repetition of the incident, it is recommended that the vent valve is not left open unattended.

Source : ICHEME

Location : ,

Injured : 1 Dead : 0

Abstract

A fire followed by an explosion occurred on a road tanker whilst being loaded with kerosene. The tanker had previously been carrying motor spirit. Compartment five was loaded first and was approximately 60% full when the explosion occurred. The driver was on top of the tanker but was only slightly injured. The fire was quickly extinguished by refinery personnel.

[loading/unloading, road tanker, kerosene, static, fire - consequence, explosion, injury]

Lessons

1. The kerosene was being bottom loaded at an initial rate of 81 m³/hr, but at the time of the incident the flow rate was at its maximum of 97m³/hr.
 2. The earthing of the pipe work arrangement at the tanker was checked and found to be correct.
 3. The inquiry concluded that the incident resulted from a static spark during switch loading and was caused by the high filling rate combined with the presence of a micro-filter.
-

1971 21 January 1980

Source : THE FIRE AND EXPLOSION AT RIVER ROAD, BARKING, ESSEX, HSE REPORT, 1980, ISBN 0717600602.

Location : River Road; Barking; Essex; Uk, UK

Injured : 9 **Dead** : 0

Abstract

A fire and explosions at a warehouse storing over 100 chemicals, including sodium chlorate and sodium cyanide. The suspected cause was radiant heat from an electric fire igniting adjacent combustible material. The fire spread through packaging materials stored nearby to involve an LPG cylinder and numerous chemicals. Evacuation.

[warehousing, overheating]

Lessons

The report emphasises the need for occupiers of similar premises to pay attention to:

1. segregating various chemicals into different categories with regard to their relevant properties
2. obtaining advice on fire precautions from authoritative sources
3. preparing adequate emergency procedures in conjunction with the emergency services.

The report recommends that all users of liquefied petroleum gas should ensure that cylinders when in use be secured in an upright position and, where reasonably practicable, be transferred from workplaces into LPG storage compounds at the end of each working day.

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

Kerosene vapours from a leaking seal were ignited by an overheated bearing on a gasoline/kerosene splitter reboiler circulation pump.

The fire was immediately extinguished by the unit operator after first raising the alarm and using a steam lance. The vapours re-ignited when the pump shaft came to rest. The second fire was extinguished by other operators using dry powder extinguishers.

The "all-clear" was given three minutes after the fire alarm was raised.

Two flow transmitters and approximately 50 m of cable were damaged.

[fire - consequence, damage to equipment, seal failure, processing]

Lessons

Vibration pick-ups and high temperature detectors can be used on pumps located in remote/isolated areas to give early warning of potential problems. Fire resistant protection is worth considering in hot pump areas.

Source : ICHEME

Location : ,

Injured : 1 Dead : 0

Abstract

A fire followed an explosion in a road tanker which was bottom loading kerosene having previously carried a cargo of motor spirit (switch loading). The tanker had five separate compartments. Compartment No. 5 at the rear was the first to be loaded and was approximately 60% full when the explosion occurred. The driver was on the tanker top at the front end of the vehicle at the time and was only slightly injured. The force of the explosion ruptured the wall separating compartment 5 from compartment 4. The subsequent fire in both compartments was extinguished by refinery personnel by closing the inspection hatch covers with the aid of a long metal pole kept on the gantry for this purpose. The enquiry team assumed that a flammable mixture existed in the compartment during the loading and was probably ignited by an electrostatic discharge from the liquid surface to the internal structure of the tank.

[fire - consequence, damage to equipment, injury]

Lessons

Since micro filters are known to produce high static charging levels in an unpredictable manner, relaxation time may need to be built into the system to dissipate the charge, e.g. by the installation of a small earthed buffer tank, the size being dependent upon the conductivity of the liquid (if the conductivity is not measured, a relaxation time of at least a 100 seconds is recommended).

Alternatively the conductivity of the product can be increased with an anti-static additive to a safe level for the particular filter application.

Bottom loading gives a higher peak voltage in the tanker compared with top loading even though the inlet charge density may be the same in both cases.

Research work to date indicates electrostatic fields 25% higher when bottom loading compared with top loading.

Measurements on oils with conductivities less than 10 ps/metre should be made using an instrument of proven accuracy.

Do not practice switch loading.

Source : ICHEME

Location : ,

Injured : 1 Dead : 0

Abstract

Two operators were using torches to light the pilot on the crude and heaters which were being purged with steam.

Kerosene was drawn from a sample point into a pot and two torches were soaked and lighted.

After the pilots were lit, the torches were extinguished with a steam hose and dumped into the pot which immediately ignited.

While attempting to remove the torches, the pot fell over and the operator's trouser leg caught fire.

Other operators extinguished the clothing fire with the aid of a fire blanket. Fortunately the operator was not badly burned.

[fire - consequence, competency lacking, burns]

Lessons

Do not use torches for lighting pilots and burners. Use a portable electrical ignitor. Where pilot burners are not fitted, the same ignitor can be used to directly light main gas burners. Heavy fuel oil normally requires more ignition energy than is provided by this type of ignitor and so a portable propane flame torch can be used.

Dry powder extinguishers provide the most effective means of dealing with a person whose clothing is on fire.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

The pressure in the flare system rose during a period when one of two flare stacks had been shut-down for maintenance. The drain from the molecular seal was found blocked and flushed free but this only partially reduced the back pressure on the system. Examination of the shutdown flare revealed that the passage through the seal was virtually choked with dirt, rust and iron sulphide. Similar deposits were found in the other molecular seal when the flare was taken out of service.

Lessons

It is important to ensure that the drain from the seal is kept free at all times.

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 1

Abstract

Scaffolding was being erected by the contractor around an LPG sphere in order to provide a safe access for engineers to inspect welds on the vessel. The scaffold was partially built when a fatal accident occurred.

No one witnessed the fall but investigations suggest that the contractor slipped on loose scaffold tubes whilst climbing down from an incomplete platform (handrails had not been installed at this time) at a height of 11 M. Fatality.

[inspection]

Lessons

[None Reported]

Source : ICHEME

Location : , USA

Injured : 0 Dead : 0

Abstract

Explosions and fire totally destroyed a battery of three butane spheres, four vertical iso-butane tanks and five horizontal propylene and LPG mix storage tanks. This group of tanks was located immediately east of the HF (hydrogen fluoride) alkylation unit, north of the product treater area and catalytic cracker rundown tanks, west of another group of rundown tanks and south of the lead plant and catalyst reformer. In the explosion and fire, all of these facilities adjacent to the battery of tanks were either totally or, in the case of the reformer, at least 50% destroyed. The radius of damage was approximately 400 feet. Objects from the explosions were found more than 1,200 feet from the centre of the tank farm.

The most probable cause for the disaster was overfilling an iso-butane tank. Iso-butane was being received by pipeline. The refinery concluded that a vapour cloud formed and was ignited, the fire surrounded the tanks which in turn ruptured. Several of the tanks went into orbit.

[Storage equipment, vapour cloud explosion, fire - consequence, damage to equipment, overflow, refining]

Lessons

Routine inspection and testing of equipment and instrumentation must be to a high standard and records must be meticulously kept.

1936 11 December 1979

Source : CHEMICAL MARKETING REPORTER, 1979, 17 DEC.; 100 LARGEST LOSSES, 9TH EDITION, MARSH & MCLENNAN PROTECTION CONSULTANTS, 1986.

Location : Ponce, PUERTO RICO

Injured : 11 **Dead :** 0

Abstract

The chemical complex had been shutdown for 24 hours when a massive failure of a 13 ft diameter dimeriser vessel occurred. The 15 ton 1 1/8 inch thick steel head travelled 1900 ft to an adjoining paraxylene plant landing on a propane refrigerant system and setting fire to one of the 3 units. The blast released 25 000 gallons of hydrocarbons as well as 80 000 galls from a nearby solvent tank. Ignition was immediate. Dicyclopentadiene, isoprene, piperylene.
[reactors and reaction equipment]

Lessons

[None Reported]

1925 11 November 1979

Source : HAZARDOUS MATERIALS ACCIDENT SPILL MAPS HAZARDOUS MATERIALS RELEASES FROM RAILROAD TANK CARS, NATIONAL TRANSPORTATION SAFETY BOARD, WASHINGTON D.C, USA, REPORT NUMBER NTSB-HZM-MAP-80-8, 1980.

Location : Molino; Florida, USA

Injured : 0 **Dead :** 0

Abstract

A rail transportation derailment. A train derailed during heavy rain at rail bed washout. LPG and other chemicals, including alcohol and acetone, escaped from rail tanker and ignited. People evacuated for 1 mile around zone; later extended to 2 miles while the remaining tanks were demolished by explosives. [weather effects, evacuation, spill]

Lessons

[None Reported]

Source : ICHEME

Location : , USA

Injured : 0 Dead : 0

Abstract

A tank exploded lifting the shell and roof completely off the floor plate. Within 10 minutes a second tank exploded in a similar manner. The resulting fire lasted two hours and fifteen minutes after which time three tanks were destroyed and two sustained substantial damage to attendant piping and insulation. An intermediate dike separating the damaged tanks from the burning tanks essentially prevented all of the tanks from being completely destroyed.

During the course of the fire, some of the oil and water mixture drained out of the diked area into a storm water ditch. As a result of the lack of a fire stop in the ditch, flaming oil was released into the interceptor basin of the nearby river.

The most probably source of the explosion was pyrophoric action caused by iron sulphides lodged between the fins of the tank heater. During the investigation it was determined that 36-40 hours before the fire, the tank which exploded had been pumped down to a level of 2-6 foot exposing the 4 foot vertical tank header. As the level in the tank remained low, the sludge and iron sulphides located between the tank header fins were allowed to dry-out thereby resulting in the pyrophoric action which acted as the source of ignition for the explosive vapour mixture that existed in the tank. Normal practice for cold weather conditions kept a small amount of steam in the tank header allowing it to dry out.

[damage to equipment, unwanted chemical reaction, fire - consequence]

Lessons

[None Reported]

1923 08 November 1979

Source : HAZARDOUS MATERIALS ACCIDENT SPILL MAPS HAZARDOUS MATERIAL RELEASES FROM RAILROAD, NATIONAL TRANSPORTATION SAFETY BOARD, WASHINGTON D.C, USA, REPORT NUMBER NTSB-HZM MAP-80-2, 1980.

Location : Inwood; Indiana, USA

Injured : 14 **Dead** : 0

Abstract

A rail transportation incident. Rail tankers derailed and punctured. Fire and explosion. Spill of acetic anhydride, butyl cellosolve, ethyl acrylate, isobutyl alcohol and methacrylic acid.

[fire - consequence]

Lessons

[None Reported]

Source : VAN MEERBEKE R.C, ACCIDENT AT LNG FACILITY, CHEMICAL ENGINEERING PROGRESS, 1982, 78, JAN. 39-45; HAZARDOUS CARGO BULLETIN, 1980, JUL., 14.
NATIONAL TRANSPORTATION SAFETY BOARD, NTSB-PAR-80-2, 16-04-1980,; CEP JAN, 1982.

Location : Cove Point; Maryland, USA

Injured : 0 **Dead** : 1

Abstract

An explosion of liquefied natural gas (LNG) vapours destroyed a transformer building at the Columbia LNG facility in Cove Point, Maryland. One person was killed, one was seriously injured and other buildings at the facility were damaged. A routine equipment check had discovered a leak at a high pressure LNG pump. It was decided to pull the circuit breaker on the leaking pump. As this was being done in the transformer building an explosion occurred. Investigation showed that LNG leaked through a termination seal, then vaporised and flowed under pressure through the motor inlet conduit seal. LNG and vapour then flowed through electrical conduit to the transformer building located 225 feet away. As the employee opened the circuit breaker, a spark ignited the gas. The Cove Point facility was not back in full production for 6 to 12 months.

[fatality]

Lessons

The National Transportation Safety Board raised 14 actions because of this incident. Also as a result of this incident, the redesigns now required for electrical/process interfaces led to changes in the National Electrical Code and the NFPA-59A standard.

The 14 NTSB actions were:

1. Action P - 79 - 31: against the American Gas Association
2. Notify AGA member companies operating similar facilities of the known particulars of the Cove Point accident and request that they inspect electrical conduit seals at their facilities and take appropriate action.
3. Action P - 80 - 26: against the Research and Special Programs Administration
4. Regulations for LNG facilities should include safety analysis, engineering specifications, inspection, fire prevention/protection, personnel qualifications and siting.
5. Action P - 80 - 27: against the Research and Special Programs Administration Require all buildings and similar enclosures in LNG facilities connected by piping or conduit to be fitted with an effective means for detecting LNG vapours and alerting company personnel.
6. Action P - 80 - 28: against the Research and Special Programs Administration Institute an ongoing inspection program for LNG facilities to ensure that they are designed, constructed and maintained in a safe condition and comply with all pertinent Federal regulations.
7. Action P - 80 - 29: against the Research and Special Programs Administration Develop criteria for safety analysis for the design of LNG facilities.
8. Action P - 80 - 30: against the Research and Special Programs Administration Establish a program for licensing or certifying individuals designated to operate LNG facilities. This to include a comprehensive written examination.
9. Action P - 80 - 31: against the US Coast Guard Promulgate regulations requiring periodic fire and emergency drills at LNG reception facilities. These drills to provide realistic training exercises.
10. Action P - 80 - 32: against the US Coast Guard Promulgate regulations which establish criteria to ensure the adequate physical protection of fire water mains and the installation of sufficient isolation valves to prevent the system from becoming compromised because of a break in any single part of the fire water system.
11. Action P - 80 - 33: against the US Coast Guard Promulgate regulations requiring the posting of a diagram or other means to show the location of all fire-fighting equipment and systems, including the fire water main and isolation valves at key locations throughout LNG reception facilities.
12. Action P - 80 - 34: against the Columbia LNG Corporation Install adequate means for detecting LNG vapours in all buildings and enclosures at Cove Point. If combustible gas detectors are used ensure that they are properly located, tested periodically and recalibrated.
13. Action P - 80 - 35: against the Columbia LNG Corporation Revise the fire-fighting training for Cove Point personnel, to include periodic emergency drills. These drills to provide realistic training exercises.
14. Action P - 80 - 36: against the Columbia LNG Corporation Install isolation valves in the fire water mains to prevent the system becoming compromised because of a break in any single part of the fire water system.
15. Action P - 80 - 37: against the Columbia LNG Corporation Post a diagram, or other means to illustrate the location of all fire-fighting equipment and systems, including the fire fighting mains and its isolation valves at key locations throughout the Cove Point facility.
16. Action P - 80 - 38: against the Columbia LNG Corporation Revise the emergency telephone list for the Cove Point facility to include the Materials Transportation Board (MTB) Office of Operation and Enforcement. Instruct employees on the importance of notifying MTB immediately of relevant accidents.

1910 01 October 1979

Source : ICHEME

Location : , USA

Injured : 0 Dead : 0

Abstract

A large vapour release, 20 000 lbs of ethylene and isopentane, occurred without ignition when valve bonnet and activator were blown off valve. The valve operated every 20 to 30 seconds and had cycled about 3000 to 4500 times when failure occurred. Less than design bolt engagement was present. Valve failure.

[gas / vapour release, bonnet valve, processing]

Lessons

The following actions were taken to prevent valve failure:

1. Actuator support welded to valve body to reduce vibration to valve bonnet retaining bolts.
 2. Bolt length increased.
 3. Bonnet valves safety wired in place.
 4. Automatic dump system purchased.
 5. The manual valve upstream of the product valve was automated.
-

10689October 1979

Source : COMPENDIUM OF SHIPPING INCIDENTS, 1967-1979, NO. 26.

Location : ,

Injured : 0 Dead : 0

Abstract

A marine transportation incident. The main thrust bearing and shaft of a ship were extensively damaged whilst the ship was on sea trials following maintenance.

The damage was caused by lack of oil due to a drain valve being open. There were signs of oil shortage early in the trials (no oil in sight glass) but these were ignored on the advice of the engine maker's representative. Subsequently, severe damage was found and the drain valve from the bottom of the thrust housing, was found to be open. It has been wrongly assumed that this was shut but this was not checked.

[damage to equipment, testing, lubricating oil, lubrication failure, operation inadequate]

Lessons

The direct costs of this incident exceeded £50,000 (1979). The damage could have been avoided by better inspection.

Disciplinary action was taken.

1084708 September 1979

Source : NATIONAL TRANSPORTATION SAFETY BOARD, HAZARDOUS MATERIALS SPILL.

Location : Paxton; Texas, USA

Injured : 8 Dead : 0

Abstract

A rail transportation incident. Two locomotives and cars in train positions 1 through 33 of a 53 car train derailed. Sixteen cars contained materials four of which included acetaldehyde, others contained butadiene, ethyl acrylate, ethylene oxide, hydrogen fluoride, isobutylene (LPG), methanol, tetrahydrofuran, vinyl acetate, plastic pellets, ethylene glycol, propylene glycol and diabasic ester. Three cars were empty.

Damage occurred to many of the tank cars causing the spillage of chemicals.

Witnesses saw the butadiene cloud ignite when two cars collided. As nearby residents fled, four received burns on their feet and four inhaled smoke. Spilled flammable liquids ignited and burned.

Between 200 and 300 people were evacuated from the area.

[derailment - consequence, gas / vapour release, vapour cloud explosion, fire - consequence, evacuation, collision, methanol]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 4 Dead : 0

Abstract

A lubricating oil fire occurred in and around, the bearing housing of a vinyl chloride monomer (VCM) pump.

One of the bearings acted as the source of ignition. Four people, of those who put the fire out, required treatment at the medical centre for sore throats and light chests. The root cause of the fire was that the pump motor and bearing cover, had become detached due to them being attached "shorter than standard" studs, which vibrated free. This released lubricating oil which was ignited when the bearings became hot. The short studs were installed when a "funnel guide" was fitted to the pump and supported from the bearing housing end, some time before the incident.

[fire - consequence, bearing failure]

Lessons

Photographs in the report, illustrated the circumstances of the fire.

The pump and other similar ones, were checked and adequacy of retaining studs ensured.

The main general lesson, however, is that before any modification is carried out, rigorous consideration must be given to the possibility of adverse consequences for safety.

A VCM was also considered but this was not a feasible possibility.

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A road transportation incident. A lorry, carrying highly flammable solvents caught fire and was extensively damaged. The load, also, was completely destroyed. There were no casualties.

It was concluded that the root cause of the fire was at the rear, offside tyres which caught fire due, either, to under inflation, or brake binding.

It was not considered practicable to entirely prevent this kind of incident (tyre fires) so the recommendations centred around measures to reduce the frequency of such events.

A nearby house was evacuated as a precaution to escape the possible effects of toxic combination gases from the loading being carried (a combination of organic esters and ketones).

[fire - consequence, damage to equipment, overheating, solvents]

Lessons

The main recommendations were:

1. Review tyre design data to ensure use of best products.
 2. Ensure high standards of wheel and tyre maintenance.
 3. Introduce spot checks on tyre condition.
 4. Review devices for "in service" tyre pressure checks.
 5. Review fire-fighting equipment on lorries and driver training in this respect.
 6. Review means of preventing spread of tyre fires to the load being carried.
 7. Increase awareness of consequences of fires involving flammable liquids.
-

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A marine transportation incident. A auxiliary vessel carrying military vehicles, and over 100 people, collided with a marine tanker in thick fog. The marine tanker carrying a cargo of 1500 tonnes of lubricating oil, capsized and had to be abandoned, causing a pollution scare. Subsequent attempts to right it failed due to inclement weather and it had to be towed to a nearby port for offloading.
[navigation error, collision, human causes, vessel overturned]

Lessons

The inquiry into the incident found the master of the auxiliary vessel guilty of gross misconduct and he lost his certificate. It was said that he broke vital rules regarding navigation in fog, including failure to sound the fog horn and sailing too quickly. He did not plot a proper course for the marine tanker when she appeared on the radar screen. There was a breakdown of communications between the master and the officer of the watch.

1868 07 June 1979

Source : THE DISASTER FILE,THE 1970S

Location : Jacksonville; Florida, USA

Injured : 15 **Dead** : 0

Abstract

Explosion and fire at an insecticide plant sent up clouds of smoke containing poisonous gases.

[fire - consequence]

Lessons

[None Reported]

11521May 1979

Source : ICHEME

Location : , BELGIUM

Injured : 0 Dead : 0

Abstract

A rail transport incident. A release of LPG from a rail tanker resulted in an explosion at a railway station. The tanker which was the source of the release was one of four standing at an LPG storage installation next to the track. The escaped gas cloud was blown towards a stationary passenger train and is believed to have had an area of 300m by 400m. The explosion took place when the train had moved a few yards and is believed to have been caused by sparks from the overhead power line. The tanker is believed to have burst at the time the train arrived in the station. The force of the explosion caused the tanker to rise 10m in the air and leave the track. The tanker itself is then believed to have exploded, projecting the manhole cover 100m. No cause of the initial failure is given. No injuries or damage other than to the failed tanker are reported.

[gas / vapour release, vapour cloud explosion]

Lessons

[None Reported]

1852 21 April 1979

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A fire occurred at a refinery lube oil plant which was caused by tube failure. Source of ignition was furnace.

[fire - consequence, refining]

Lessons

[None Reported]

1833 05 March 1979

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A fire occurred in a refinery xylene plant involving a centrifuge and lube oil. Cause: mechanical equipment failure. Source of ignition was hot surface.
[fire - consequence, refining]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

An explosion occurred during discharge of LPG into storage.

Approximately 5 minutes after commencing the unloading operation, the driver, who was standing 30 m from the vehicle, noticed flames around the meter cabinet on the vehicle. He ran to the vehicle to switch off the engine but found that the diesel engine had stopped and hence the delivery pump, driven by the engine, had also stopped. He attempted to put out the fire using small fire extinguishers, and having failed to do so, he summoned the fire brigade. The fire brigade arrived, but made no attempt to cool the tank with water, even though the vehicle tank was not fitted with a pressure relief valve. After 20-25 minutes the tank failed and a BLEVE (boiling liquid expanding vapour explosion) occurred.

The vehicle and retail outlet buildings were severely damaged, but all personnel were clear of the site when the BLEVE occurred.

[BLEVE, LPG, loading/unloading, road tanker, flange/seal failure, flange failure, leak, gas / vapour release]

Lessons

Three possibilities were considered in trying to identify the source of the initial leakage:

1. Leaking/damaged delivery hoses.
 2. Discharges from pressure relief valve on discharge pump delivery line.
 3. Cracked flange connection on hose reel inlet and incorrect type of seal used.
 4. The possibility of a leaking hose was ruled out, as it had been replaced two months earlier.
 5. A new discharge pump had been fitted to the vehicle two days before the incident and although tested, it was thought that the pressure relief valve may possibly have lifted due to a fault in the pump valves.
 6. The inlet flange on the hose-reel had been cracked for some time, the crack had probably occurred during fitting, when the incorrect type of seal had also been fitted. The flange was also constructed of non standard material.
 7. From the evidence it was concluded that vapour escaping from the flange/seal was primary cause of the accident and in the absence of any other ignition source, the vapour entered the air inlet side of the running vehicle diesel engine and ignited. (It is thought that the diesel engine stopped after the initial ignition due to lack of oxygen).
 8. Although the vehicle was not fitted with a pressure relief valve, it was thought highly dubious in this instance, as there was no cooling water applied at all, whether the relief valve would have prevented a BLEVE.
-

1830 27 February 1979

Source : THE EVENING SUN, 1985, 17 DEC.

Location :

Injured : 5 Dead : 0

Abstract

A metal box containing magnesium exploded behind firefighters as they fought a magnesium fire in a road vehicle.

[fire - consequence, explosion]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : Dead :

Abstract

During commissioning of an air operated valve on the bottom of a dump tank was opened, polymer and residual isobutane were discharged to atmosphere. Although an attempt was made to close the valve, polymer and isobutane continued to be discharged and subsequently ignited.
[gas / vapour release, vapour cloud explosion, operation inadequate]

Lessons

The following recommendations were made:

Procedures for preparing the dump tank before emptying the contents must be carried out and in addition the outside senior operator or process foreman must be satisfied that the contents have been purged sufficiently before emptying and then supervise directly the dumping operation.

1816 10 January 1979

Source : FINANCIAL TIMES, 1979, 11 JAN.; CHEMICAL WEEK, 1979, 17 JAN.

Location : Montreal; Quebec, CANADA

Injured : 0 **Dead** : 5

Abstract

Explosion at magnesium plant.

Lessons

[None Reported]

Source : ICHEME**Location** : , UK**Injured** : 0 **Dead** : 0

Abstract

A fire occurred when a catalyst was taken out of commission in a loop reactor due to a blockage in the polymer drier. The following morning the reactor was in a standby position, with one settling leg in commission to the dump tank. It was estimated that the dump tank contained about 12 tonnes of polymer and it was decided to route the reactor to the flash tank, to enable the dump tank to be emptied. The dump tank was prepared for emptying by being isolated and purge six times by pressuring with nitrogen and venting to blowdown. The 10" air operated valve on the bottom of the dump tank was opened and polymer and residue isobutane were discharged to atmosphere. Although an attempt was made to close the valve, polymer and isobutane continued to be discharged and subsequently ignited.

The following conclusions were made:

1. Purging of the dump tank contents before emptying was inadequate.
2. After the fire, the dump valve pneumatic controller was found in a position which would keep the valve open in normal circumstances. We conclude therefore that the valve was in the open position until the plastic air supply lines were destroyed by the fire.
3. Two possible sources of ignition were the catalyst activator and static discharge.

[fire - consequence, reactors and reaction equipment, decommissioning]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A tank farm operator reported an arc of light (corona) around a handrail and instrument housing during a short hail storm while a sample was being taken from a floating roof kerosene tank.

The floating roof tank was fitted with shunts, electrically bonded at the top and bottom of the rolling ladder and fitted externally with earthing straps. The electrical continuity of these facilities was later checked and found to be satisfactory.

At the time of the incident, the operator was standing on the dipping platform taking a sample cage suspended on natural fibre (not synthetic) cord. The tank was full and had been standing 18 hours without movement. As soon as the operator touched the handrail, the visual corona disappeared.

[corona, near miss, electrically charged, hail, floating roof tank, weather effects]

Lessons

The type of hail which occurs with Force 5 winds is known as 'soft hail' or 'Graupel' and is electrically charged. It is possible to charge paint electrically by impact from the hail stones and electrification might also occur by hail stones bouncing off the surface of the tank. If the paint resistance is high (especially polyurethane paint), it can become electrically charged and under some conditions visual corona can occur.

Sampling or dipping should not be undertaken during electrical or hail storms and, if already in hand, should be stopped immediately and the operator should leave the dipping platform as quickly as possible closing all tank openings.

When material which forms a flammable vapour is stored in fixed roof tanks then efforts should be directed towards minimising the frequency of tasks undertaken on tank roofs, and consideration given to installing automatic gauging facilities.

1792 18 December 1978

Source : POLYTECHNISCH TIJDSCHRIFT PROCESTECHNIEK 1981,VOL 36 NO. 4,; ICHEME SYMPOSIUM SERIES NO.80.

Location : Nijmegen, NETHERLANDS

Injured : 0 **Dead** : 0

Abstract

A road transportation incident. A road tanker filled with LPG burst causing a BLEVE (Boiling Liquid Expanding Vapour Explosion) occurred, some time after a fire started under the vehicle. In the explosion the whole tanker and filling station were destroyed. After investigation it was established that the fire very probably started as the result of a torn and/or leaking connection, caused by an assembly fault when attaching the hose reel. LPG got under the tanker by streaming out from this leak. Hot parts of the tankers engine subsequently were the source of ignition.

Lessons

[None Reported]

1788 11 December 1978

Source : 100 LARGEST LOSSES, MARSH & MCLENNAN PROTECTION CONSULTANTS LTD.

Location : Salisbury; Harare, ZIMBABWE

Injured : 0 **Dead :** 0

Abstract

22 of 28 tanks containing diesel, jet fuel and gasoline were destroyed during a 3 day fire. Source of ignition was tracer bullets and rockets. The terminal covering 40 acres was largely destroyed. Terrorism.
[fire - consequence, explosion]

Lessons

[None Reported]

1694 26 July 1978

Source : EVENING GAZETTE, 1978, 27 JUL.

Location : Graythorpe; Hartlepool, UK

Injured : 0 **Dead** : 0

Abstract

Leak caused irritation and difficulty in breathing of local residents. Iron chloride released.

[gas / vapour release]

Lessons

[None Reported]

1688 15 July 1978

Source : LEWIS DR D.J, CASE STUDIES OF EFFECTS OF LIQUID FUEL FIRES AND OF VAPOUR CLOUD FIRES AND EXPLOSIONS, IN: SYMPOSIUM ORGANISED BY SCIENTIFIC AND TECHNICAL STUDIES SPONSORED BY HAZARDOUS CARGO BULLETIN, LONDON, 16-17 JUNE, 1982;

Location : Xilatopec, MEXICO

Injured : 200 **Dead** : 100

Abstract

A road transportation incident. A road tanker carrying 36.4 tonnes of LPG ran onto the left shoulder of a dual carriageway and overturned. The LPG started to leak and formed a minor aerial explosion followed by a major running liquid fire. The fire engulfed 3 buses and 2 trucks. Fatality.
[fire - consequence]

Lessons

[None Reported]

1650 30 May 1978

Source : 100 LARGEST LOSSES, 9TH EDITION, MARSH & MCLENNAN PROTECTION CONSULTANTS LTD., 1986

Location : Texas City, USA

Injured : 10 Dead : 7

Abstract

An unidentified failure led to the release of light hydrocarbons which ignited. An intense fire followed in the tank farm and a sphere failed within 5 minutes and sent missiles throughout plant. Within 20 minutes, five horizontal bullets, four vertical bullets and one sphere failed from missile damage or the BLEVE (Boiling Liquid Expanding Vapour Explosion). Pieces of the tanks travelled in all directions falling into operating units and tank farms and starting further fires. Fragments hit the fire water tank and electric pumps. Two diesel pumps were used. The accident was caused by the rupture of an isobutane storage sphere which had been overfilled and overpressured due to the failure of its level monitoring equipment.

[overflow, overpressurisation, mechanical equipment failure, propane, butane, fatality]

Lessons

1. Propane tank batteries preferably should be isolated to more remote sections of the plant. Spheres also should be remotely located whenever possible.
 2. The positioning of the propane tanks should be done in such a manner as to point or "aim" them away from major valves or occupancies. These tanks when ruptured act as bullets and become missiles. The spheres, more than likely, will rise vertically with the footings acting as launching pads.
 3. Early warning is needed in the event a vapour cloud is forming.
 4. A low dike should be built, if possible, around the butane spheres to help contain the heavier vapour.
 5. A method of cooling the tanks to prevent vaporisation should be installed.
 6. Alarms are needed to warn operators of high levels in the tanks or the presence of hydrocarbon vapour in the area.
 7. It is extremely important to maintain good records of the type and age of all safety and operating equipment used in conjunction with the operation of these tanks. This includes both field and board mounted equipment. It is equally as important to maintain a record of all maintenance work orders and routine inspections of this equipment.
 8. Tight and properly maintained seals are very important on the unit charge and product transfer pumps.
 9. Ground should slope away from the tanks in the direction of prevailing wind.
-

Source : ICHEME

Location : , USA

Injured : 0 Dead : 0

Abstract

A large oil refinery storage tank (75 m dia by 15 m high) containing catalytic cracker feed (plus some light ends) was struck by lightning during a severe storm. This resulted in a fire at the tank roof seal (the tank being of the floating roof type). The fire took about four hours to extinguish using both cooling water on the shell of the tank and foam injection nozzles. The fire caused appreciable damage to the tank. Because of the design of the tank seals, it was impossible to extinguish the flames completely until foam was applied from a hose at the top of the tank. [refining, floating roof tank, fire fighting equipment, fire - consequence, damage to equipment]

Lessons

The following recommendations were made:

1. Design changes should be made to tank seals to improve access to foam.
 2. Greater supplies of foam should be available.
 3. Traffic control and portable lighting at the scene of the incident should be improved.
-

1633 01 May 1978

Source : ICHEME

Location : , INDONESIA

Injured : 0 Dead : 0

Abstract

An explosion and fire occurred on a gas stabilisation unit involving natural gas liquids (NGL), LPG and cone roof tank. Source of ignition was the flare.
[fire - consequence, storage tanks]

Lessons

[None Reported]

1622 15 April 1978

Source : 100 LARGEST LOSSES 9TH EDITION, MARSH & MCLENNAN PROTECTION LTD., 1986.

Location : Abqaiq, SAUDI ARABIA

Injured : 0 **Dead** : 4

Abstract

A 22 inch LPG pipeline, mainly methane, operating at 500 psig developed a leak due to internal corrosion. The leak expanded and the line parted releasing a vapour cloud near a large gas processing unit. After about 7 minutes ignition occurred from a flare locate 1500 ft downwind. The jet action of escaping gas threw a 22 ft section of pipe 400 ft where it struck the vapour space of one of two spheres. A second vapour cloud formed and was ignited by the first fire. The detonation developed overpressure of 7.8 psi. Fatality.

[vapour cloud explosion]

Lessons

[None Reported]

1608 27 March 1978

Source : ICHEME

Location : , LIBYA

Injured : 0 Dead : 0

Abstract

A fire occurred involving a pump and lube oil at a fertiliser ammonia plant which was caused by gauge glass failure. Source of ignition was hot surface.
[fire - consequence]

Lessons

[None Reported]

1593 24 February 1978

Source : LOSS PREVENTION BULLETIN, 105, 1-6; NATIONAL TRANSPORTATION SAFETY BOARD, WASHINGTON D.C, USA, REPORT NTSB RAR-79-1.; LOSS PREVENTION IN THE PROCESS INDUSTRIES, F. LEES.

Location : Waverly; Tennessee, USA

Injured : 50+ **Dead** : 12

Abstract

This incident involved the rail transportation of LPG. The 17th to 39th cars of a 96 car freight train derailed at a facing switch causing the front part of the train to come to an emergency stop. Amongst the derailed cars were two propane carrying cars. The propane cars were showing some external signs of damage to the tanks, but were not leaking. During clearing of the track the 18th tank car ruptured, whilst no activity relating to any of the tank cars or vehicles was taking place. A few seconds later, the cloud of propane vapour and mist ignited from an unknown source to produce a vapour cloud explosion followed by a fireball. Not all parts of the cloud burnt explosively with other parts of the cloud behaving as a flash fire, liquid pools of propane burning on the ground and also a rising fireball with continual radiation from combustion as seen in a BLEVE (Boiling Liquid Expanding Vapour Explosion). Blast damage was reported together with the effects of the fireball radiation and engulfment of items in the burning cloud.

The fracture of the tank was found to have started at the point where a gouge like scrape crossed a weld between the second and third shell sheets from the leading end.

[fire - consequence, derailment, fatality, injury]

Lessons

[None Reported]

1570 31 January 1978

Source : CHEMICAL MARKETING REPORTER, 1978, 6 FEB.; CHEMICAL WEEK, 1978, 8 FEB.

Location : Lake Charles; Louisiana, USA

Injured : 0 **Dead** : 0

Abstract

Oxygen and ethylene explosion and fire started at mix nozzle. Lines ruptured in several places, instrument power failure activated shutdown system but oxygen flow restarted at increased rate. Head blown off reactor, two explosions occurred, the second involving the kerosene coolant system. Pipework found 150 m away.

[mechanical equipment failure, processing]

Lessons

[None Reported]

1567 30 January 1978

Source : CHEMICAL ENGINEERING, 1978, 12 FEB.

Location : Mayhew Flats; Leon; Kentucky, USA

Injured : 0 **Dead** : 0

Abstract

A rail transportation incident. Thirteen rail tanker cars derailed. Three hundred nearby residents were evacuated as a precaution due to a fire that followed the derailment.

It is reported that river pollution has occurred as a result of the incident.

Chemicals involved; acrylonitrile, LPG and resins.

[fire - consequence, derailment, evacuation, leak]

Lessons

[None Reported]

104351978

Source : HEALTH AND SAFETY MANUFACTURING AND SERVICE INDUSTRIES 1978.

Location : ,

Injured : 0 **Dead :** 0

Abstract

An emission of propane occurred when the flexible liquid and vapour coupling hose at a railway tanker unloading depot were broken. This occurred when a train was moved without the couplings first being disconnected. A self closing valve prevented any large discharge from the rail tanker and an alert worker closed a manually operated valve at the storage tank inlet. Nevertheless, the contents of several hundred feet of the 8 inch diameter fixed line vaporised, amounting to approximately 1 tonne of LPG. The emergency procedures which were put into effect resulted in a section of the adjacent motorway and railway line being closed for several hours. Had the vapour cloud ignited and flashed back to the storage installation, which included large numbers of LPG cylinders, the consequences would undoubtedly have been much more serious.

[storage tanks, gas / vapour release, mechanical equipment failure]

Lessons

[None Reported]

107461978

Source : HEALTH AND SAFETY, MANUFACTURING & SERVICE INDUSTRIES 1978.

Location : ,

Injured : 0 Dead : 0

Abstract

A major incident occurred at a chemical plant when there was an escape of 9000 litres of LPG. Shipping and rail traffic in the area was brought to a halt. The leak happened due to a pair of flanges on a 100mm line had been left unbolted. Three pipelines had been split to allow hydraulic valves to be fitted and the reconnection of the lines was left to the night shift to complete. A supervisor using a torch thought he had located all the unbolted flanges but in the dark he missed one.

When the plant was taken back into use, LPG leaked. Unfortunately the operators on the plant had not had training on the new hydraulic valves and thought that they had been closed. The LPG continued to escape for twenty minutes, until the plant engineer arrived and closed the valves. Employees were caught in the control room which was almost surrounded by the vapour, fortunately it did not ignite. Investigation of the incident revealed that no system had been laid down for work on pipelines at this plant. Action was taken and a penalty of £300 (1978) was imposed.

[gas / vapour release, operation inadequate, training inadequate, permit to work system inadequate, maintenance, near miss, inspection]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A hydrodesulphuriser reactor had two catalyst beds. The upper one rested on a heavy support grid designed for 1.7 bar differential pressure. However, there were only pressure gauges on the reactor inlet and outlet.

The pressure drop across the reactor rose during the run and the last time it was checked it was 3.3 bar. It had been assumed that there would be the same pressure drop across each bed. However, the support grid then collapsed. On investigation it was found that there had been a solid crust of fine iron sulphide on the top bed and so most of the pressure drop had been there.

[iron sulphide, reactors and reaction equipment, damage to equipment, flow restriction, high pressure]

Lessons

Crust plugging the surface of catalyst beds are not uncommon and so a HAZOP on this unit before start-up could have revealed the danger of relying on the overall pressure drop to protect the support grid.

When a catalyst bed plugs the pressure drop rises at an increasing rate. Thus checking should be more and more frequent as the limit is approached. It is likely that the failure occurred at a substantially higher figure than 3.3 bar.

1492 23 November 1977

Source : EVENING GAZETTE, 1977, 24 NOV.; THE TIMES, 28 NOV.

Location : Nantycaws; Carmathen; Dyfed, UK

Injured : 0 **Dead** : 5

Abstract

A road transportation incident. Collision between road tanker containing LPG and a car. Car cut in two. Fatality.

Lessons

[None Reported]

Source : ICHEME

Location : , USA

Injured : 0 Dead : 0

Abstract

A rail transportation incident. A train with several tank cars containing motor fuel anti-knock compound, (LPG) liquid petroleum gas and ethylene dichloride derailed.

The two cars of ethylene dichloride exploded and burned and one car of LPG butadiene inhibited burned.

As a result of the derailment, approximately 250 residents of the nearby area were evacuated. Fire trucks were called to the scene along with a foam truck.

There were no injuries or deaths.

The apparent caused of the incident was due to a bad cross level at the joints causing an empty car to rock off.

[derailment - consequence, evacuation, rail broken, explosion, fire - consequence]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 134, 3-4.

Location : ,

Injured : 1 Dead : 0

Abstract

A sight-glass, situated in the drain line of a diluent drier, blew out and shattered whilst the drier was being prepared for regeneration. An operator was showered with glass and liquid isobutane. The operator received several minor lacerations and cold burns to the face though with no permanent injury. An investigation identified two possible causes of this incident, but could not positively identify any sequence of events which could have definitely led to either of these.

1. Over-pressure of the section of drain line in which the sight-glass was located.
2. Failure of the sight-glass below its safe working pressure.

Four possible mechanisms for over-pressure were identified:

1. The drain line block valve, downstream of the sight-glass caused a back pressure. The drain line from the drier passes via two block valves rated 40 bar(g) after which the design pressure changed to 10 bar(g). The sight-glass was rated at 12 bar(g), and downstream of this was a further block valve common to a second drier intended for use when additional plant was installed. This valve was found to be 2 and 1/2 turns open after the incident. However, tests using water showed that, even in this position, the valve would not have restricted draining to any significant extent.
2. Small amounts of drier material could have been lost to the drain lines. However, water flushing of the drain lines at a high rate did not result in any appearance of drier material from the lines.
3. The possibility of blocking, due to released traces of water from the drier, followed by 'flash-chilling' across the valve and the formation of ice was considered. There was no evidence of a high frequency of blockages that this theory would have implied.
4. Hydraulic shock failure of the glass was considered. There was no restriction downstream, that could have led to a sufficiently high hydraulic pressure capable of causing this.

[overpressurisation, gauge glass failure, spill, heating, injury]

Lessons

The following recommendations were made:

1. The block valve downstream of the sight-glass should be removed. Further, in general, unnecessary valves should be identified and removed so as to reduce the chances of restrictions due to inadvertent closure.
2. If valves need to be open to ensure safe operating conditions, they should be chained, or otherwise fixed, in the open position.
3. Sight-glasses should be of a design that affords protection from accidental damage and rated at a safe pressure well above the line pressure that they are likely to encounter.

Further Recommendations:

1. Alternatives to sight-glasses could and for hazardous material handling should be used. Pressure gauges could have been used, which would have indicated that the line was clear and would have been less liable to damage.
2. Due to the high pressures encountered, safety relief systems may have been advisable to protect the sight-glass if an alternative was not feasible.
3. Since the operation was carried out two to three times a year, then a pre-commissioning audit/review should have been carried out, with the scope of any Hazop including such transient modes.

Source : ICHEME

Location : , UK

Injured : 1 Dead : 0

Abstract

An eruption occurred on a reactor during processing of plasticised latex and partial loss of contents to atmosphere.

Plasticised latex was being manufactured by heating a PVC copolymer latex with plasticiser and soaps, to form PVC copolymer particles. During the first-stage heating process, the clockwork mechanism on the temperature recording chart drive failed and was repaired and the zero adjusted. During second-stage heating, the temperature reached 134 degrees C on the chart recorder, which was 6 degrees C above that specified. This amount of overshoot, however, was apparently considered normal.

At the start of the shift the following morning, the recorded temperature of 46 degrees C was higher than the normal 20 - 25 degrees C, and difficulty was experienced in loosening the nuts on the manhole cover because the solidified reactor contents were pressing on the underside of the manlid. The top of the reactor was too hot to touch and was cooled by spraying it with water. During further attempts that morning to remove the cover, the reactor contents erupted. The pressure inside the reactor sheared all but two of the remaining cover bolts, forcing the manlid cover to swivel and resulting in the ejection of a considerable amount of brown degraded reactor material.

The reactor had a protective device in the form of a bursting disc. The disk had blown but the solid polymer had extruded up the vent line above the disk thus causing it to block. The pressure gauge on the reactor registered zero at the time of the incident, but this was caused by polymer blocking the line.

One worker received minor burns in the incident.

The company investigation into the incident, which included pilot plant testing, concluded as follows:

1. The polymer latex/plasticiser mixture was heated to 140 degrees C, which was higher than the usual 128 degrees C. This resulted in a 6 degrees C overshoot on heat-up, and a 6 degrees C offset in the temperature recording system. This temperature difference was due to incorrect zero adjustment of the chart recorder during repair.
2. The temperature reached was sufficiently high to cause destabilisation of the latex, and thickening of the reactor contents.
3. Subsequent exothermic degradation of the destabilised latex, possibly catalysed by iron contamination in the presence of air, kept the reactor contents at a high temperature and pressure. The situation was further aggravated by the viscous nature of the latex in the reactor. The result was a rapid ejection of reactor contents when the cover was opened.

[product loss, reactors and reaction equipment, vent blocked, explosion / pressure release]

Lessons

1. The steam system for the latex reactors to be automated to prevent the polymer contents exceeding the specified temperature of 128 degrees C.
2. A separate audible alarm should be installed to warn operators of an increase above the specified reactor temperature.
3. Procedures for calibrating temperature recording systems should be revised.
4. The existing pressure relief system to be re-designed because it appears to be inadequate to handle unusual situations.
5. An investigation to be carried out to determine if a lower operating temperature can be used.
6. An alarm to be installed to indicate failure of the agitation system, because failure results in destabilisation of the latex.
7. Iron contamination of the reactor to be prevented. In particular, the strainers on the steam system should be replaced.
8. The existing operating procedure requires revision. The revision to include the action needed should the reactor contents solidify.

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

Fire at a production stabiliser plant. Source of ignition was hot surface. Equipment involved: gas turbine generator. Substance involved: lube oil. Cause: weld failure.

[fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

An explosion occurred involving a drum containing methyl acrylate waste in a chemical plant where latex was being manufactured.

The plant in question manufactured PVC latex by copolymerising ethyl and methyl acrylate monomers with vinyl chloride. The acrylates were delivered in drums and the contents pumped to feed tanks which in turn feed the reactors where the polymerisation reaction takes place. When changing monomers, the contents of the feed tanks were drained into drums for disposal.

The drum that exploded contained waste drained from the feed tanks. The explosion sheared the drum completely from its base and propelled it into the roof girders, spraying polymerised latex residue over a wide area. Following the explosion, operators entered the area wearing breathing apparatus and cleaned up the residues by scraping and washing down.

The exact cause of the explosion was not determined but it was concluded that the drum was contaminated with water and iron/rust which caused the contents to self-polymerise, in turn leading to overpressurisation of the drum.

Investigation found that the monomers being used contained lower amounts of methyl hydroquinone inhibitor than specified by the supplier. The acrylate actually being used contained 5 - 10 ppm inhibitor whereas it should have contained 10 - 20 ppm according to the specification. Both water and rust contamination were also suspected as contributing to the self-polymerisation. Water causes a problem because the inhibitor is more soluble in the water than the acrylate. Rust was suspected because the feed tanks are pressurised with inert cause which was known to be wet and contaminated with rust.

[drums, processing, contamination, spill, unwanted chemical reaction, storage]

Lessons

1. The site storage, handling and disposal of acrylate esters to be reviewed. In particular, the polymer feed tank system to be examined with a view to providing an air blanket above the acrylate esters. (It was discovered that acrylate esters should not be stored under an inert blanket because the inhibitor requires oxygen in order to function).
2. Levels of the methyl hydroquinone inhibitor in the acrylates should be checked with the supplier. Higher levels than recommended should be considered.
3. More detailed testing of acrylate ester raw material should be carried out.
4. A specific procedure for the handling and disposal of acrylate esters should be prepared.

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

Fire at a production oil stabilisation plant. Source of ignition was hot surface. Equipment involved: gas turbine generator. Substance: lube oil. Cause: weld failure.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

An explosion occurred in a lubricating oil reservoir of a centrifugal gas compressor at a crude oil gathering centre.
[processing]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Explosion in lube oil reservoir of centrifugal gas compressor rupturing the reservoir and causing considerable damage. The explosion was caused by carry over of buffer gas fuel and ignition by static.

[rupture, damage to equipment]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

On the 30th July 1977, three offsite operators who were in the vicinity of an LPG pumpstation observed that there was a fire around the pumps. The control room was informed and the fire alarm raised.

When the operators approached the fire they found that a half inch pressure gauge tapping on a regasser pump (No. 2 pump) was broken and that escaping propane had ignited. There also appeared to be a fire at a vent valve on the adjoining pump to the left (No. 1) and around the seal of the pump to the right (No. 3).

While one of the operators stopped and shut the suction and discharge valves of the No.2 pump the other operators attacked the fire with dry powder extinguishers. All the fires were put out and the "all clear" given within five minutes of the start of the incident.

The No.2 pump had been commissioned some five minutes before the incident to transfer liquid propane to the regasser.

After the incident the following conclusions and findings were made:

1. The screwed pressure gauge connection on No.2 pump was completely broken off at the pump housing. Because of the stiff connection of the other end of the gauge line to the vent line the gauge line remained in its position.
2. The electric motor of No.2 pump was found jammed with the coupling between the pump and its motor broken.
3. It was probable that the vent valve of the No.1 pump and the seal of the No.3 pump were leaking slightly and that under the pressure of about 13 bar the leaking jet from the No.2 pump had been sufficient to ignite these smaller leaks.
4. No explanation was found for the fracture of the half inch screwed connections.
5. It was postulated that the broken connection and emission of the jet of LPG could have caused an imbalance of the pump, followed by failure of its coupling and the jamming of the motor.
6. Sparks produced during this stage were assumed to have ignited the leaking propane.

[processing, pump, pressure meter/control, connector, mechanical equipment failure, gas / vapour release, fire - consequence, LPG, propane]

Lessons

An in-depth review of pipework at the LPG pumpstation was conducted. Increased radiographic surveys were made, and any screwed connections in the system back-welded.

1414 02 July 1977

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

Fire at a refinery lube oil plant. Source of ignition was autoignition.

[fire - consequence, refining]

Lessons

[None Reported]

1405 25 June 1977

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A fire occurred on a utilities plant. The source of ignition came from a hot surface in the area. Equipment involved: gas turbine generator. Substance involved: lube oil. Cause: seal failure.
[fire - consequence]

Lessons

[None Reported]

1394 15 June 1977

Source : JOURNAL, 1977, 16 JUN.

Location : Warenford A1; Northumberland, UK

Injured : 0 **Dead** : 0

Abstract

A road transportation incident. Lager removed from road tanker which had overturned. Road closed for 7 hours.

[road incidents]

Lessons

[None Reported]

1340 20 February 1977

Source : LENOIR E.M & DAVENPORT J.A, A SURVEY OF VAPOUR CLOUD EXPLOSIONS SECOND UPDATE, PROCESS SAFETY PROGRESS, 1993, 12, (1), 12-33.

Location : Dallas; Texas, USA

Injured : 0 **Dead** : 0

Abstract

A rail transportation incident. A rail tanker ruptured during derailment and released isobutane. Ignition occurred about 2.5 minutes later. Violent explosion and shock felt miles away.

Lessons

[None Reported]

Source : LEWIS D.J, CASE STUDIES OF EFFECTS OF LIQUID FUEL FIRES AND OF VAPOUR CLOUD FIRES AND EXPLOSIONS, IN: THE RISKS OF FUEL TRANSPORT, SYMPOSIUM ORGANISED BY SCIENTIFIC AND TECHNICAL STUDIES AND SPONSORED BY HAZARDOUS CARGO BULLETIN, LONDON, 16-17 JUNE 1982.

Location : Polmadie; Glasgow, UK

Injured : 1 **Dead :** 0

Abstract

An LPG road tanker was unloading propane to a tank when a hose failure caused propane to be released which was then ignited by the engine of the tanker used for unloading. The tanker was only 4 metres away from a fixed storage tank and the tanker's outlets were facing directly towards the storage tank. A drencher system failed to operate and the fire brigade had to cool the tanker and fixed tank by means of jets. Before the cooling was sufficient, the relief valve on the heated tank operated and the released gas stream ignited. When the tank had been cooled sufficiently, the relief valve reseated and the jet flame extinguished itself. A total of 55 tonnes of propane was consumed by the fire. The cost of the fire was £45,000 (1977).

[fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A rail transportation incident. A rail tanker of LPG BLEVE'd (Boiling Liquid Expanding Vapour Explosion) after derailment.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 1 Dead : 0

Abstract

A 30ft. section of the 10 inch overhead rundown line on a crude oil distillation unit was required to be cut out and renewed. The line was supported by a hanger and slide. Gas freeing operations were completed and a hot work permit was issued. Electric arc cutting started at 11:10 hr, and when the pipe was almost cut through, the welder stopped work and moved back to await crane support before completing the cut.

At 12:20 hr the 30ft section of 10 inch line fell from its support, onto the pipe track below and in doing so struck a 1 inch bypass line around the LPG product flow controller. The 1½ inch line was wrenched from its 1½ inch API Socket and there was an immediate release of LPG which ignited. The LPG burned for about two minutes until the 3 inch section of the line between the battery limit and flow control valve had depressured.

The welder jumped off the overhead piperack at the beginning of the incident and sustained a fractured ankle.

Fire Department personnel observed the ignition of the LPG from their Station and were quickly on the scene applying cooling water to an adjacent column structure, and extinguishing smouldering material.

It was extremely lucky that the section of LPG line struck by the falling 10 inch line contained only a limited quantity of LPG. Had there been a long section of line back to isolation valves, or the 3 inch line itself had been struck, the fire would have been more difficult to control and extinguish.

[maintenance, pipe, unidentified cause, fire - consequence, LPG]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A rail transportation incident. A faulty relay on the safety interlocks for an LPG rail loading facility let the mule move the rail cars while there were still connected to the loading point. This stretched the loading arm and broke the coupling. The problem was compounded because the manual shut down was also routed through the faulty circuit. The loading arm is now fitted with quick break self sealing couplings and a restraining chain to protect the arm.
[rail tanker, loading arm, rupture, product loss, design inadequate, safety equipment failure, inspection inadequate]

Lessons

Electrical circuitry for safety interlocks must be designed so that it fails safe. In this case to prevent the winch from moving one contact on a relay had to make. The relay failed. The winch should have been inhibited when there was no power on the relay and the contact was open.
Emergency shutdown switched should operate directly on the motor starter. They are needed when normal controls fail and should not operate through them.
Excess flow valves like other safety equipment which actuates infrequently must be checked on a regular basis.

1292 22 December 1976

Source : EVENING GAZETTE, 1976, 22 DEC.

Location : Fawley; Southampton, UK

Injured : 2 **Dead** : 0

Abstract

Fire at rail loading bay facilities handling LPG in oil refinery.

[fire - consequence]

Lessons

[None Reported]

1290 16 December 1976

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Fire at a refinery olefin plant. Source of ignition was hot surface. Equipment involved: pump. Substance involved: lube oil.

[fire - consequence, processing]

Lessons

[None Reported]

1280 26 November 1976

Source : NATIONAL TRANSPORTATION SAFETY BOARD, WASHINGTON D.C, USA, REPORT NUMBER NTSB-RAR-77-7

Location : Belt; Montana, USA

Injured : 22 **Dead** : 2

Abstract

A rail transportation incident. 24 rail tanker cars of a train were derailed by the failure of an overloaded rail section which originated in a rail transverse fissure. One tank car struck and punctured a 16 000 gallon tank containing gasoline which ignited and which was 42 ft from the railway line. A tank car of LPG ruptured, ignited and rocketed 400 ft. Fuel oil in other tank cars also ignited. Later a tanker of LPG BLEVE'd (Boiling Liquid Expanding Vapour Explosion). [derailment - consequence, rail incidents, fatality]

Lessons

[None Reported]

Source : ICHEME

Location : , HOLLAND

Injured : 0 Dead : 0

Abstract

A quartz sulphur analyser in a Dutch laboratory was severely damaged by fire, and subsequently the analyser had to be replaced.

The quartz sulphur analyser was being used to determine the sulphur content of gas oil and fuel oil samples. In the test, a quartz tube is heated with an LPG burner. The LPG is piped into the laboratory from a gas bottle store, with copper piping around the laboratory and valved offtakes at strategic locations, leading through short rubber hoses to user equipment.

The analyser had been in use some 30 minutes when the technician had to leave the laboratory for some 10 minutes. On his return the analyser was on fire with considerable smoke and flame to a height of 3 ft. above the analyser. The fire was extinguished with a CO2 extinguisher and the gas supply isolated.

The burner supply hose was found to be detached, and it is considered that a jet of burning gas had entered the analyser compartment, burning and destroying its electrical components.

The most likely cause of the incident was thought to be a small hole in the rubber supply hose through which LPG leaked and ignited, leading to the detachment of the hose from the burner.

The alternative possibility of the hose being "blown off" was considered as less likely, nevertheless in future all such hoses will be provided with hose clamps, and regularly inspected for wear.

[laboratory work, fire - consequence, gas / vapour release, near miss, damage to equipment]

Lessons

Where a test involves a considerable degree of open heating and heat radiation such as this, it is unwise to leave the equipment unattended for even a few moments.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Some changes had to be carried out on a pipe system between storage tanks and the production building. Due to a misunderstanding it was believed that the product flow from storage to production was blocked off and therefore a valve on the pipe system was left open. When the storage tank circulation system was switched on, the pipe system became pressurised and through the open valve, insecticide solution flowed on the floor of the production building.

Production personnel thought to be master of the situation since in this building the floor drains were always sealed off with plugs. However, one drain, hidden under a pallet, was not plugged, and through this drain some 3000 litres of insecticide ran out into the river.

[environmental, spill, design or procedure error, storage tanks]

Lessons

[None Reported]

Source : FIRE JOURNAL, MARCH 1977.

Location : , USA

Injured : 0 Dead : 0

Abstract

Two 100 lbs. cylinders of propane were being removed from the basement boiler room of a school, when one cylinder accidentally toppled back down the stairs. The cylinder valve assembly broke off, releasing LPG, which then ignited, leading to a confined vapour/air explosion. Due to the strength of construction of the boiler room, explosion effects were quite limited, and there were no injuries to the students in the school, even though it was fully occupied at the time. The explosion occurred about 5 seconds after the valve was damaged, and it is estimated that about 12.5 lbs. of liquid propane was released before ignition. Explosion overpressure is estimated at 6-7 psi. The source of ignition is thought to have been one of the boilers. (Later ignition of the release would have resulted in greater damage).

[gas / vapour release, overpressurisation]

Lessons

Adequate protection of cylinder valves and stems is essential where the location or movement of the cylinders renders them liable to damage.

1219 24 July 1976

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Explosion at a petrochemical lube oil additives plant. Source of ignition was autoignition. Equipment involved reaction vessel. The cause was operator error.
[processing]

Lessons

[None Reported]

1179 16 May 1976

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

Fire at a refinery desulphuriser plant. Source of ignition was autoignition. Equipment involved, heat exchanger. Substance involved: kerosene. Cause: flange leak.

[fire - consequence, refining]

Lessons

[None Reported]

Source : ICHEME**Location :** ,**Injured :** 0 **Dead :** 0

Abstract

On 10th March, at 6.25 hrs. an escape of vapours was observed in the pump area of this LPG Storage Area by an operator of the adjacent LPG Loading Station.

The operator immediately alerted the tank farm operators, and a foreman operator arrived within a few minutes. Having established that a 1 inch drain valve underneath a 2 inch propylene rundown line had fallen to the ground the refinery fire brigade was alerted. The fire brigade remotely actuated the water spray systems on all (8) of the LPG spheres and commissioned 2 fixed water cannons. At the same time, the rundown line was valve isolated at both ends.

The weather was extremely cold, with a temperature of around 10 degrees C. Whilst the rundown line was being depressurised through the drain nozzle, the leakage repeatedly froze over, due to the formation of ice, and then thawed, because of the steam tracing on the line. After the steam tracing had been shut off and a temporary line for depressurisation at the catalytic cracker had been installed, the escape of vapours ceased at approx. 7.25 hrs.

The subsequent investigation showed that the body of the 1 inch ball valve was screwed to the end fittings and then seal welded. It is believed that during the construction of the refinery (1967) one of the end fittings had been removed from the valve and welded onto the 1 inch branch of the 2 inch line, the remainder of the valve being then assembled. During this operation the body could not have been fitted correctly as the threads were severely damaged. As the end fitting was not concentrically fitted, the 'O' ring was found to be only 20% effective, and the end fitting was not seal welded to the body. The seal face and the body showed severe corrosion from which it was considered that a minor leakage could have been present for some time. The leakage could have been sealed, and there-fore become unidentifiable, by water collecting in the short leg below the 2 inch line. Some 80 similar ball valves of the same make in the LPG Storage Area were subsequently inspected, but no other defects were found.

[storage, storage tanks, storage sphere, valve, ball valve, corrosion, gas / vapour release, near miss, LPG]

Lessons

[None Reported]

12043March 1976

Source : ICHEME

Location : , USA

Injured : 0 Dead : 0

Abstract

A rail transportation incident. In March 1976, empty butane railcars were to be removed from a refinery sidings by a railroad company.

There were eight railcars between the locomotive and the two empty railcars to be removed. The shunter was in radio communication with the locomotive driver, but was not sited in such a position as to have visual observation at the time that contact was made with the two railcars. There was also loss of radio communication at this critical time, and the moving train hit the empty railcars driving them through the standard railroad buffers and off the end of the track. The end butane railcar dropped onto a pipetrack, pipes in the latter feeding the railcar and roadcar loading racks.

A release of light hydrocarbons occurred, which appeared to be coming from damaged pipelines since, although the leading railcar's undercarriage was damaged, it's tank was intact.

There was only limited refinery manpower in the area at the time of the incident, namely, one operator and an accounting clerk.

The six discharge/suction valves on loading rack pumps were closed within 15 minutes of the derailment, but liquid/gas continued to flow out of a ruptured pipe in the piperack, and from the noise level it was felt that there was a high pressure vapour discharge. This could have been from either propane or butane balance or rundown lines, and it was therefore necessary to isolate at the tops of storage vessels, nine cylindrical and one spherical vessel being involved.

The assistance of a maintenance man was necessary to get one valve on a propane vessel to close. All valves were closed within an hour and high pressure gas flow then ceased although liquid butane continued to flow for about another hour due to a volume of 2.5m downstream of the nearest isolating valve.

There was a 15 mph wind at the time which dissipated vapours into an open area where there were no ignition sources and therefore ignition did not occur.

As a precaution two water monitors were positioned to cool the tankcar should this have become necessary.

[rail transport, pipeline, derailment, gas / vapour release, LPG]

Lessons

Subsequent to the incident:

1. Un-required lines in the piperack were disconnected, and a 2 inch valve installed in the propane vapour line so that all propane vessels could be isolated by a single valve.
2. The piperack was filled with sand and the rail track extended beyond the piperack so that a derailed car would not fall onto unprotected piping.
3. A sand barrier some 10m long, by 1.3m high, by 4m wide was placed on the track as well as the standard buffers.
4. Because of problems with the one inoperable propane valve, a procedure was established to check infrequently operated valves in the area on a monthly basis, defective valves to be repaired promptly.

1120 26 January 1976

Source : ICHEME

Location : ,

Injured : 22 Dead : 2

Abstract

A rail transportation incident. A rail tanker of LPG BLEVE'd (Boiling Liquid Expanding Vapour Explosion) after derailment. Fatality.

Lessons

[None Reported]

1118 26 January 1976

Source : SUN, 1976, 26 JAN.; THE TIMES, 1976, 27 JAN.

Location : , NORTH SEA

Injured : 0 Dead : 0

Abstract

A road tanker in the hold of a marine transport vessel overturned spilling its contents of isobutyl acetate. The ship was refused permission to dock until the danger was over.

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A laboratory technical assistant was withdrawing LPG from a sample bomb to carry out a test when the valve spindle blew out. Luckily the spindle was facing towards the ground and the man was not injured.

The valve was one of three new valves that had recently been fitted to LPG sample bombs to replace the original standard valves which were leaking.

Although these new 1/4 inch valves met the required pressure rating, they were of the type where the nut holding the spindle in place on the valve had a tendency to unscrew. Subsequently it was found that because the correct valves were not available at the time, the lab instrument maintainer had fitted non-standard 1/4 inch valves. On checking other non-standard valves their nuts were also found to be loose, and the bombs were withdrawn from service.

The refinery has now ensured that standard valves (which will not unscrew) are fitted to all the LPG sample bombs and the stock of non-standard 1/4 inch valves will only be used on water service.

[sampling, laboratory work, valve, incorrect equipment installed, near miss, LPG]

Lessons

The gradual unscrewing of valve spindles in operation from certain types of valve is a feature that has been appreciated in plant use for many years, and such valves are normally relegated to low hazards services such as water duties, or avoided altogether.

Refinery laboratories are advised to alert their maintenance staff to this hazard.

1046 01 September 1975

Source : RAILROAD ACCIDENT REPORT DERAILMENT OF TANK CARS WITH SUSEQUENT FIRE AND EXPLOSION, NATIONAL TRANSPORTATION SAFETY BOARD, WASHINGTON D.C, USA, REPORT NUMBER NTSB RAR-76-8, 1976.

Location : Des Moines; Iowa, USA

Injured : 3 **Dead :** 0

Abstract

A rail transportation incident. A rail tanker train derailed in fog at a facing point switch. Derailment of 11 cars which contained LPG led to a release and BLEVE (Boiling Liquid Expanding Vapour Explosion).
[fire - consequence]

Lessons

[None Reported]

1016 29 April 1975

Source : HIGHWAY ACCIDENT REPORT TANK SEMITRAILER OVERTURN EXPLOSION AND FIRE, NATIONAL TRANSPORTATION SAFETY BOARD, WASHINGTON D.C, USA, REPORT NUMBER NTSB-HAR-76-4, 176; LENOIR E.M & DAVENPORT J.A, A SURVEY OF VAPOUR CLOUD EXPLOSIONS SECOND UPDATE, PROCESS SAFETY PROGRESS, 1993, 12, (1), 12-33.

Location : Eagle Pass; Texas, USA

Injured : 0 **Dead** : 17

Abstract

A road transportation incident. A road tanker overturned causing mechanical rupture of the tank and a release of vaporised LPG. Immediately an explosion occurred followed by another. The probable cause was the evasive action taken by the truck driver to avoid a slowing vehicle. Fatality.

[road incidents]

Lessons

[None Reported]

Source : ICHEME

Location : Baytown, Texas, USA

Injured : 0 Dead : 0

Abstract

A mechanical seal failed on one of three pumps used to transfer LPG from a group of eleven propane drums. Normal discharge was through a six inch pipeline to storage caverns nearby.

A delivery of propane was completed at 05:30. The operator going offshift noted in his log that the pump was making excessive noise and needs to be checked. Early on the following shift the technician visited the pump slab but the propane pumps were not running. The technician then went on to other work.

At 09:30 later the console operator initiated a new transfer of propane using the same pump. At 13:10 the computer log indicated the pump had shutdown. Later investigation showed that the drums involved were empty because of a fault level indicator. The pump evidently lost suction and kicked off a low discharge pressure. At 13:24, with another bank of full drums lined up, the pump was restarted. Within 3 minutes computer printouts listed "unauthorised valve operation". Actually, burned control wires had caused unauthorised operations. At about the same time an emergency call reported fire in the pump area. The firefighters arrived promptly and used first two stationary monitor nozzles and later three fire hoses to cool the pumps and adjacent piping. Propane drum outlet valves were closed under cover of fog nozzles and proximity suits. The pump suction and discharge valves were closed and the fire subsided.

Complete extinguishment was about 14:50. Damage was confined to the pump slab area but included wiring, instrumentation, valves and piping as well as other pumps and motors on the slab. There were no personnel injuries.

After investigation it was found that:

1. It is thought that the cause of the incident was due to vertical motor thrust bearing failure which led to seal failure and the fire.
2. The LPG pump was equipped with tandem mechanical seals, but there was no instrumentation to warn of failure.

[seal failure, material transfer, mechanical equipment failure, human causes, fire - consequence, damage to equipment]

Lessons

1. Failure to observe and act upon the notation in the operator's log regarding excessive noise.
 2. Care to be exercised in locating instrument leads to minimise exposure.
 3. Consideration to be given to fire proofing.
-

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

In polyester tests, fibre samples are boiled over an electric hotplate in a glass beaker containing 25-30 cc of 64 per cent hydrazine. The procedure calls for use of glass rods for handling the sample. In this case, the laboratory technician used a pair of metal tweezers which were old and somewhat rusty. When the tweezers were put into the hot hydrazine solution to remove the samples, the hydrazine ignited. The fire remained within the beaker and there was no damage or personal injury.

The cause of this incident was spontaneous ignition of hydrazine in the presence of iron oxide introduced on the tongs.

The ignition temperature is 75 degrees F in the presence of iron oxide and 518 degrees F in a glass container.

In the presence of iron oxide, the spontaneous ignition temperature of 75 degrees F is below the normal flashpoint of 100 degrees F. The technician involved in this incident was not aware of this unusual characteristic in hydrazine.

[laboratory work, testing, unwanted chemical reaction, rusting, spontaneous combustion]

Lessons

Emphasise the need for using glass utensils with hydrazine.

Select lab equipment with minimal iron content (such as a ceramic-top hotplate) for working with hydrazine.

The reduction in spontaneous ignition temperature due to the presence of iron oxide is interesting and certainly indicates what could happen if a hydrazine soaked rag was discarded into a rusty rubbish drum.

Source : ICHEME

Location : , GERMANY

Injured : 0 Dead : 0

Abstract

While carrying out a hot tapping operation on a 10 inch isopentane line, product sprayed out of the stuffing box of the cutter spindle. Fortunately ignition did not occur.

During the subsequent investigation it was found that:

1. There was no flow in the line.
2. A fire attendant had not been specified on the work permit for the actual hot tap operation, only during the associated welding work.
3. Some 10 metres away additional welding work was in hand.
4. The hot tapping equipment was not pressure tested before use, hence the absence of packing in the stuffing box was not detected.

The refinery written procedures for the use of hot tapping equipment in fact covered all of the above points. A circular has now been distributed to those concerned with the use of hot tapping equipment, reminding them of the requirements for such work.

[hot work, tools & access equipment, testing inadequate, near miss]

Lessons

Hot tapping machines should be hydraulically tested before use.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A serious fire developed in the turbine house of this refinery which generated both its own steam and electricity.

The rupture of a diaphragm in a control valve allowed lubricating oil to spray into a basement area of the power station. The oil contacted an uninsulated section of a 900 psig steam line and ignited.

Briefly, loss of oil pressure to the turbogenerator also takes pressure off the steam control valve diaphragm allowing the steam driven auxiliary pump to cut in and re-establish oil pressure. The steam control valve was of an open body design and failure of the diaphragm allowed oil to spray into the atmosphere. The oil spray continued until the 500 gallon oil reservoir emptied, feeding the fire. Two turbogenerators were involved in the fire area, and loss of their electrical generation capacity was accompanied by the loss of pass out steam. Electrical load shedding according to a pre-scribed electrical emergency procedure was in hand, transferring from electrical to steam usage. This created a greater than normal demand on the 190 psig steam system. This would normally have been taken up by pass out from the 900 psig supply through the 400 psig let down stations, in turn to the 190 psig system. Unfortunately the 900 psig to 400 psig station failed to open on automatic, and further failed to respond when switched to manual control by the operator. The 400 psig boilers could have picked up the load to maintain the 400 psig system, but their load was not increased as false indication in the boiler house gave a normal pressure of 412 psig whereas the true pressure was only 325 psig. Eventually these false readings were recognised and the 400 psig boiler steaming rate increased and the 900 to 400 psig let down station manually jacked open.

Recognition of the problems and prompt action by the operating personnel in opening the let-down stations mitigated most of the effects of the steam loss to the refinery. The initial period after the fire demonstrated the inter-relationship between the various parts of the refinery, and the existence of good emergency action plans, tested by 'dry runs' did much to limit the effects of the emergency. The value of two way radio communication was also proved during the incident. In running up a standby turbine it was found that wiring for the external governor control had been damaged in the fire, preventing the control centre operator from synchronising the speed of the turbogenerator with the system. This difficulty was overcome by using two-way radios and manually adjusting the turbine throttle until the speed was synchronised.

[refining, power plant, turbine, valve, mechanical equipment failure, fire - consequence, leak]

Lessons

The modifications made by the refinery to correct the situation included the following:

1. The open type valve bodies were replaced with a closed type, with the breather vent piped back to the lube oil reservoir.
2. The above valves were removed from proximity to high pressure steam lines.
3. Critical pressure gauges, and let down valves are to be tested on a routine basis to ensure operational integrity.
4. A stand-by group of four to six two-way radios were made available solely to meet emergency situations

It is also recommend that refineries should include simulated total service failures as part of their emergency exercises The failure of ancillary equipment (pressure gauges, let down valves) during the emergency, illustrates the need to test such equipment on a routine basis.

Source : HSE TRANSLATION 9625, BROOD T.G.P, FIRES CAUSED BY LIGHTNING STRIKES IN TWO PROTECTED TANKS FOR THE STORAGE OF COMBUSTIBLE LIQUIDS.

Location : , NETHERLANDS

Injured : 0 **Dead :** 0

Abstract

A metal storage tank of 5000 cum (cubic metres) encased in concrete and covered with earth was one third full of aircraft fuel. Lightning struck a tree adjacent to the tank and then the tank exploded. A fire started and the tank was allowed to burn out. The strike on the tree was photographed. Investigation thought that a path could be traced from the tree and into the tank via a cable.
[explosion, fire - consequence, storage tanks, gasoline, jet fuel]

Lessons

[None Reported]

Source : HOUSTON CHRONICLE, 1989, 24 OCT.; FIRE AND EXPLOSION RISK CONTROL IN THE PETROCHEMICAL INDUSTRY, COMMERCIAL UNION RISK MANAGEMENT LTD. TECHNICAL REPORT NO.2, 1976; VERVALIN C.H, HPI LOSS INCIDENT CASE HISTORIES, HYDROCARBON PROCESSING, 1978, 57, FEB., 183-201.

Location : Beaumont; Texas, USA

Injured : 0 **Dead** : 2

Abstract

A vapour cloud explosion and ensuing fires resulted from a spill of 16,800 gallons of in-process hydrocarbon liquid and gases discharging through a broken expansion joint in the suction line of a pump. The explosion created blast waves that broke numerous process lines, resulting in multiple fires in the isoprene synthesis plant and adjoining tank farm. Fatality.

[fire - consequence, vapour cloud explosion, expansion joint failure, processing]

Lessons

[None Reported]

Source : FINANCIAL TIMES, 1974, 29 NOV.; CHEMICAL AGE, 1974, 6 DEC.; EUROPEAN CHEMICAL NEWS, 1974, 6 DEC.

Location : Duxford; Cambridge, UK

Injured : 0 Dead : 0

Abstract

Explosion occurred in the monomer unit of polyisoprene and polybutadiene plant. A vat overheated.
[processing, overheating]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Failure of control valve on lubricating oil pump resulted in oil spray and spontaneous ignition on 900 psig steam main. Fire damaged power station.
[fire - consequence, valve failure]

Lessons

[None Reported]

Source : ICHEME.; HAZARDOUS CARGO BULLETIN OCTOBER 1984.

Location : , JAPAN

Injured : - Dead : 33

Abstract

A marine transportation incident. The marine tanker (carrying both LPG and naphtha) collided with a bulk carrier in a busy shipping lanes. Damage to the tanker extended about 24 metres longitudinally and from the main deck to below the waterline.

Following the impact, large volumes of naphtha flowed from the ruptured hull of the tanker, and ignition occurred almost immediately. Five crew members of the tanker were killed, and all but one of the twenty nine crew of the bulk carrier died.

The damaged ships were towed to safe locations, but the tanker continued to burn for nearly three weeks after the collision. She was eventually sunk by deliberate bombardment.

Despite the intense fires and explosions (mainly fuelled by naphtha) the LPG tanks appear to have remained largely intact.

[propane, butane, marine transportation, fire - consequence, spill, fatality, collision, navigation error, safety procedures inadequate, damage to equipment]

Lessons

The root cause of the collision appears to have been confusion over the navigational rules in the area. (Neither vessel was carrying a pilot.) The channel was subsequently more clearly marked by a buoy, and all vessels flying foreign flags, and those carrying hazardous cargoes, are required to carry pilots.

The incident was cited as a demonstration of good design of the LPG tanks themselves, but raised questions about the construction of vessels carrying both LPG and other flammable cargoes.

951 14 October 1974

Source : THE TIMES, 1974, 15 OCT.; FINANCIAL TIMES, 1974, 16 OCT.; CHEMICAL AGE, 1974, 18 OCT.; EUROPEAN CHEMICAL NEWS, 1974, 18 OCT.; CHEMISTRY AND INDUSTRY, 1974, 2 NOV.

Location : Pernis, NETHERLANDS

Injured : 12 **Dead** : 0

Abstract

Reactor section of 70 000 ton per year isoprene plant set on fire after gas exploded while tank was being filled.
[fire - consequence, fire - explosion, reactors and reaction equipment, material transfer]

Lessons

[None Reported]

Source : RAILROAD ACCIDENT REPORT HAZARDOUS MATERIALS ACCIDENT, NATIONAL TRANSPORTATION SAFETY BOARD, WASHINGTON D.C, USA, REPORT NUMBER NTSB-RAR-75-4, 1975 ; LENOIR E.M & DAVENPORT J.A, A SURVEY OF VAPOUR CLOUD EXPLOSIONS SECOND UPDATE, PROCESS SAFETY PROGRESS, 1993, 12, (1), 12-33.

Location : Decatur, Illinois, USA

Injured : 0 **Dead** : 7

Abstract

A rail transportation incident. Rail tankers loaded with isobutene gas were uncoupled by a switching crew and allowed to free roll on a yard track. One of the tankers impacted with an empty boxcar, and its coupler over rode the tanker coupler, causing derailment and puncture of the tank. Isobutene escaped and vaporised before it exploded. The probable cause was the overspeed impact between the heavy cut of the tankers and the uncoupled light boxcar, which resulted from the release of the tankers at a higher than acceptable switching speed. The lack of written guidelines to assist the switchman in determining the proper switching speed contributed to the accident. The crewmembers' lack of understanding of the risks involved in switching hazardous materials also was a contributing factor. Fatality.

Lessons

[None Reported]

1010419 July 1974

Source : ICHEME

Location : , USA

Injured : 152 Dead : 7

Abstract

An explosion devastated a railway yard. The explosion resulted from ignition of a large cloud of vapour leaking from a railway tanker containing liquefied isobutane. The tanker's head was punctured during shunting operations. The vapour ignited and flashed over an area approximately half by quarter of a mile. Seven people within the railway yard were killed, and there were numerous injuries. More than 500 freight cars were involved in the explosion and ensuing fires. Effects of the explosion were felt 45 miles away, and 2000 homes and commercial structures were damaged.

Evacuation of all residences and businesses within a three-mile radius of the blast centre was ordered. Fire-fighting was hampered by the lack of any water supply in the railway yard itself. No attempt was made to completely extinguish fires but rather to knock down fire for access purposes and to identify cars carrying hazardous materials, which were then protected in place by hose streams or removed from the area. Fire-fighting operations continued for several days.

[fatality, rail transportation, evacuation, vapour cloud explosion, gas / vapour release, injury]

Lessons

[None Reported]

881 28 March 1974

Source : EUROPEAN CHEMICAL NEWS, 1974, 29 MAR.

Location : Chalampe, FRANCE

Injured : 0 **Dead** : 1

Abstract

Explosion in plant. Substance involved: latic acid. Fatality.

Lessons

[None Reported]

1025426 March 1974

Source : ICHEME

Location : Ichihara City, JAPAN

Injured : 3 **Dead :** 1

Abstract

During preparation for a turnaround inspection of a No. 2 kerosene gas oil desulphurisation unit, a gas containing 30% hydrogen sulphide blew off from a flanged portion of the condensate separating vessel in No. 3 gas recovery plant.

The incident was caused when a man from a subcontractor company erroneously loosened the flange bolts. In removing the cap of the bend valve positioned at the head of the condensate separating vessel.

One person was killed and one seriously, two slightly injured.

[fatality, human causes, maintenance, gas / vapour release, injury]

Lessons

[None Reported]

1256922 March 1974

Source : ICHEME

Location : Sakai City, JAPAN

Injured : 0 **Dead :** 0

Abstract

A marine transportation incident. A cargo ship collided with a pier due to strong winds causing piping on the pier to rupture and spill a small amount of LPG. No one was injured in the collision.

[pipe]

Lessons

[None Reported]

Source : NATIONAL FIRE PROTECTION ASSOCIATION 1974.; RAILROAD ACCIDENT REPORT DERAILMENT AND SUBSEQUENT BURNING OF A RAILWAY FREIGHT TRAIN, NATIONAL TRANSPORTATION SAFETY BOARD, WASHINGTON D.C, USA, REPORT NUMBER NTSB-RAR-74-4, 1974; EISENBERG N.A, VULNERABILITY MODEL, NATIONAL TECHNICAL INFORMATION SERVICE REPORT AD-A1025-245, SPRINGFIELD VA, 1975.

Location : , USA

Injured : 0 **Dead** : 0

Abstract

A rail transportation incident. A train consisting of three locomotives and one hundred and twenty two freight cars. As the train approached a town the first twenty seven freight cars derailed. The last seven of these were tank cars, each containing 30000 gallons of propane. Within seconds of the derailment a huge fireball had erupted, the origin of which was thought to be propane leaking from a ruptured tank. The local fire department received a call at 16:18, informing them of the derailment and referring to "gas" as being the material involved. A 750 gpm pump and 5 fire-fighters were despatched to the scene, arriving at 16:35. The officer in charge had interpreted "gas" to mean gasoline, and had not been informed about the original fireball. On this basis, and with several mutual aid companies on their way to the scene, the officer felt able to cope with the situation and deployed a 1.5 inch handline from the pump in an attempt to cool the LPG tanks. Two mutual aid companies arrived at the scene and each also placed 1.5 inch handlines in service to cool the tanks. Shortly after this, some of the LPG tank car relief valves operated and a jet of burning gas from one car impinged directly on an adjacent tank. An attempt was made to deploy a 2.5 inch hose but the water supply was inadequate for this purpose. At ca 16:49 a decision to withdraw from the fire ground was made and it was whilst this order was being relayed that the first of four BLEVEs occurred. This event caused half of the total injuries resulting from the incident. During rescue activities a second BLEVE occurred at 17:00 and this resulted in the balance of injuries being sustained. All rescue attempts were discontinued and the area was evacuated. The final BLEVEs took place at 17:10 and 17:20, without resulting in any further casualties.

[derailment, evacuation, fire - consequence]

Lessons

Four factors were believed to account for the fact that no lives were lost during this incident:

1. Most of the fire-fighters were in a field that was ten to fifteen feet below the level of the road bed and the fireball passed over their heads.
2. Orders to evacuate the area had been given seconds before the first BLEVE occurred and most of the fire-fighters had turned away from the scene immediately before the explosion.
3. There was a four inch layer of snow on the ground which provided some cooling to those fire-fighters caught in the blast.
4. One of the tanks which did not BLEVE until later on during the incident was thought to have provided some degree of shielding from the first and possibly the second BLEVE. There was no immediate threat to life in the rural location where the derailment occurred. The fire department may have made a "no attack" decision if it had known that the derailed tanks had already been heated up by a previous fireball.

Source : NORTHERN ECHO, 1974, 24 FEB.

Location : Austin; Texas, USA

Injured : 0 **Dead** : 4

Abstract

Transportation. Series of explosions in LPG pipeline. Fatality.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 6 Dead : 4

Abstract

An explosion occurred on a storage plant. Fatality.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 2 Dead : 0

Abstract

A flash fire occurred in the acid sewer system of this alkylation unit. Two men suffered from suspected HF (hydrogen fluoride) poisoning and were taken to hospital but were released within two days without any ill effects. Damage to equipment was mainly limited to special instrumentation (level recorders with radioisotope sources) and ordinary instrumentation, two plastic huts, instrument and electrical cabling.

At the time of the incident, the alkylation plant was on warm circulation during a short scheduled shut down of the cat. cracker. A small leak developed on a thermowell on the 12 inch suction line to the acid circulation pump, and it was decided to carry out repairs after normal flushing of the line with isobutane to the relief gas scrubber. After evaporation in the scrubber, lime water was added and the residual mixture drained from the scrubber knock out pot to the neutralization pit. Unfortunately the neutralization pit liquid level was low, due to a previous routine transfer from the pit, and also insufficient time had been allowed for evaporation of isobutane in the relief gas scrubber.

As a result of this low pit level most of the acid sewer system was exposed and the isobutane product evaporated from open drains. A light SW wind blew the vapours towards the isostripper reboiler furnace where ignition occurred and the resulting fire propagated throughout a section of the acid sewer network.

Men from adjoining plants and firemen who quickly went to help fight the fire unwittingly exposed themselves to potentially serious injury from HF vapour.

Fortunately the concentration of HF in the escaping hydrocarbon was so small as to be virtually harmless, but it could have been other-wise and all persons in the refinery have been alerted to this risk.

[shut-down, repair, sewer, line, operation inadequate, gas / vapour release, fire - consequence, asphyxiation, isobutane, hydrogen fluoride, injury]

Lessons

The following recommendations were made:

1. Sufficient time (at least 3 hours) should elapse between the flushing of line with isobutane and the drainage of the knock out pot of the relief gas scrubber.
2. The minimum operational level of the neutralization pit should be maintained above the level of the acid sewer inlets to achieve complete isolation of the different branches of the system. This can be realised by adding a vertical elbow (ca 1 ft. high) at the effluent outlet pipe
3. Provision of 4 self contained air sets (providing sufficient air for about 20 minutes) for emergency action so that at least the respiratory tract and the eyes are protected from H.F
4. Prohibition of any plastic hut on process units (the two huts destroyed were rebuilt with brick)

Source : ICHEME

Location : , BELGIUM

Injured : 0 Dead : 0

Abstract

A flash fire was ignited in the acid sewer system of an oil refinery alkylation unit when isobutane vapour was wind-blown towards an isostripper reboiler furnace. The incident occurred after a suction line to the acid circulation pump had been flushed with isobutane to the relief gas scrubber, in preparation for the repair of a leaking thermowell. After evaporation in the scrubber, lime water was added and the residual mixture was drained to the neutralisation pit. However, a previous routine transfer from the pit meant that the liquid level was low, exposing most of the acid sewer system. In addition, insufficient time had been allowed for the isobutane to evaporate in the scrubber, creating the conditions in which ignition was able to occur. Plant personnel and fire-fighters were exposed to potentially dangerous HF vapours, but the concentration was too low to cause injury. The fire also caused damage to instrumentation equipment, two plastic huts and electrical cabling.

[fire - consequence, drains & sewers, leak, weather effects, gas / vapour release, damage to equipment]

Lessons

There should be at least three hours left between the flushing of line with isobutane and the drainage of the knock out pot of the relief gas scrubber.

The minimum operational level of the neutralisation pit should be kept above the level of the acid sewer inlets, so that complete isolation of the different branches of the system is maintained. This can be achieved by adding a vertical elbow at the effluent outlet pipe.

Self contained air sets should be provided for personnel so that the respiratory tract and eyes can be protected from HF vapour in the event of an emergency.

Site huts should be built in brick rather than plastic.

Source : ICHEME

Location : ,

Injured : 0 Dead : 2

Abstract

A serious accident which took the lives of two men was reported from an LPG bottling plant.

Information received suggests that an inexperienced assistant and driver of a contractor's LPG bridger were transferring the vehicle's cargo into the storage bullet without supervision from the depot.

They opened the filling line valve without properly connecting the loading hose and there was a massive release of gas. The gas cloud enveloped the full bridger and ignition occurred almost immediately probably because the engine had been left running. Both men were badly burned and later died in hospital. Minutes after the initial outbreak the vehicle exploded, carrying the fire to nearby factories and warehouses. Water sprays on the storage bullet were actuated during the early stages of the incident, but failed after about 10 minutes due to an unknown cause.

Due to the presence of many gas bottles and other flammable materials at the site the fire brigade could do little more than contain the fire and allow it to burn out. Fatality.

[vapour cloud explosion, fire - consequence, operator error, warehousing, storage equipment, material transfer, competency lacking]

Lessons

The incident clearly highlights the importance of establishing and maintaining disciplinary control at loading or off-loading gantries.

This is particularly important where contractors' employees are concerned and it is strongly recommended that an assurance of competence is obtained following completion of an approved training course, either run by the company or the contractor. The incident also emphasises the importance of automatic valves and fixed water sprays at LPG loading/discharging gantries.

Source : ICHEME

Location : ,

Injured : 0 Dead : 2

Abstract

A serious accident which took the lives of two men occurred at an LPG bottling plant. Information received suggests that an inexperienced assistant and driver of a contractor's LPG bridger were transferring the vehicle's cargo into the storage bullet without supervision from the depot. They opened the filling line valve without properly connecting the loading hose, a massive release of gas occurred. The gas cloud enveloped the full bridger and ignition occurred almost immediately probably because the engine had been left running. Both men were badly burned and later died in hospital. Minutes after the initial outbreak the vehicle exploded, carrying the fire to nearby factories and warehouses. Water sprays on the storage bullet were actuated during the early stages of the incident, but failed after about 10 minutes due to an unknown cause.

Due to the presence of many gas bottles and other flammable materials at the site the fire brigade could do little more than contain the fire and allow it to burn out.

[material transfer, fire - consequence, burns, fatality, competency lacking]

Lessons

This incident clearly highlights the importance of establishing and maintaining disciplinary control at loading or off-loading gantries.

This is particularly important where contractors employees are concerned and it is strongly recommended that an assurance of competence is obtained following completion of an approved training course, either run by the company or the contractor. The incident also emphasises the importance of automatic valves and fixed water sprays at LPG loading/discharging gantries.

Source : VERVALIN C.H, HPI LOSS INCIDENT CASE HISTORIES, HYDROCARBON PROCESSING, 1978, 57, FEB., 183-201.
DAVENPORT J.A, A SURVEY OF VAPOUR CLOUD INCIDENTS, CHEMICAL ENGINEERING PROGRESS, 1977, 73, SEP., 54-63.

Location : Texas, USA

Injured : 9 **Dead** : 2

Abstract

Pipe failure led to spill of 7600 kg of C5 plus hydrocarbons. Explosion knocked out deluge system and electrical feed to fire pumps. Most damage from ensuing fire. Maximum overpressure estimated from damage was 24 kpa at 37 m. Explosive equivalent of 900 kg TNT was estimated giving a yield of 1%. Isoprene unit. Fatality.

[fire - consequence, pipeline failure, processing]

Lessons

[None Reported]

Source : ICHEME

Location : California, USA

Injured : 0 Dead : 2

Abstract

Fourteen unattended LPG tank cars on a siding had their brakes released by trespassers causing five of the cars to enter a branch track where they hit a locomotive on the branch line which was used only once a day. Three tank cars were derailed as a result of the incident which occurred in a cutting about 20ft wide, 20ft deep and 430ft in length. The leading LPG car suffered large tears in the leading end and approximately 20,000 gallons of propane spilt out into the cutting forming a heavy mist cloud above pools of liquid propane. Two railroad employees on the locomotive were killed as a result of freeze burns and propane asphyxiation. A vapour cloud formed, overflowed from the cutting and went through a tank farm where there was an open flame boiler burning just outside, through a compressor plant in which several electrical and diesel drives were operating and several vehicles drove through the cloud. The vapour cloud was not ignited by any of these and was dispersed safely.

[rail transport, gas / vapour release, fatality]

Lessons

[None Reported]

Source : ICHEME

Location : Kawasaki City, JAPAN

Injured : 0 **Dead :** 0

Abstract

A level liquid indicator failed on a gas washer of a kerosene desulphurisation plant causing liquid to spill and ignite. The fire was extinguished within twenty minutes.

The cause of the incident was due to gas leaking through a gasket, which damaged the glass covering of the level indicator. No one was injured in the incident.

[instrument/controller, fire - consequence]

Lessons

[None Reported]

1254521 September 1973

Source : NATIONAL FIRE PROTECTION ASSOCIATION, 1974.

Location : Richmond, Virginia, USA

Injured : 0 Dead : 0

Abstract

A road transportation incident. A road tanker carrying approximately 7,000 gallons of jet fuel overturned and caught fire.

Fuel oil spilled from the tanker and was on fire as fire fighters arrived on the scene.

Water and aqueous film forming foam was used in the efforts to extinguish the fire and to stop the fuel spill from going any further.

The tank, made of aluminium, melted down to liquid level as the fire progressed making fire fighting difficult as water not evaporated sinks to the tank bottom and increased the spill fire problem.

No progress was being made using water. Protein foam was then used but to no affect.

A fire truck carrying AFFF was then sent for and shortly after arriving at the scene extinguished the fire using 35 gallons of AFFF concentrate.

After the hot metal was thoroughly cooled down the remaining 3,000 gallons of hot fuel was pumped from the open tank compartments to another tank truck.

Estimated loss was \$37,000 (1973). No one was injured in the incident.

[fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 7 Dead : 0

Abstract

Whilst maintenance work was being carried out on the SO₂ (sulphur dioxide) kerosene extraction unit, at a refinery, a sudden release of SO₂ rich kerosene and SO₂ gas occurred, which resulted in seven persons being taken to the refinery medical centre. All the men were discharged before the end of the working day, but subsequently four of them lost time from work.

The SO₂ compressor was being worked on by maintenance fitters. The machine had been valve isolated, and preparations were being made to remove the non-return valve to blank-off the discharge line. The fitters were wearing airline face masks, and were working from a scaffold platform.

Earlier in the day, the adjacent compressor, which had received attention by the refinery maintenance department, had been run up on test, with its discharge valve open and the suction closed. In order to test it on line it was necessary to open the air-operated suction valve. It is thought that by mistake the air-operated suction valve on the compressor, which connects to the common suction header, was opened momentarily, releasing a quantity of SO₂ -rich kerosene and SO₂ gas from the unbolted suction flange.

Investigation showed that the relative positions of the controls for the compressors air-operated valves could be confused. This has now been rectified and the controls have also been fitted with a locking device for use before blanking operations are carried out.

[maintenance, compressor, design inadequate, gas / vapour release, asphyxiation, kerosene, sulphur dioxide, injury]

Lessons

Maintenance and operating activities should be phased to ensure that hazardous situations of this kind are not created.

2798 23 May 1973

Source : ICHEME

Location : , FINLAND

Injured : 0 Dead : 0

Abstract

An incident occurred on a plant with a capacity of 76,000 m3. At the time of the fire it contained 5,000 m3 of motor spirit 1,200 m3 of kerosene, 170 m3 of tractor fuel, and 21,000 m3 of fuel oil.

The fire began in a pumphouse at about 03.00 hours on the morning of the 23rd May and rapidly spread to nearby motor spirit tanks.

Fire fighting was made difficult due to a lack of appropriate equipment. The only adequate foam gun had to be brought from an airport 20 km away and it was necessary for extra supplies of foam to be transported by air and road (516 kms). Finland's total reserves. Fire fighting was further hampered by a breakdown of most of Finland's telecommunications because of a strike.

Eight of the storage tanks were destroyed along with much depot equipment and the damage is estimated at a total of £1 million (1973).

[damage to equipment, fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : , USA

Injured : 4 Dead : 0

Abstract

Following a catalyst regeneration a fire occurred on a hydrocracking unit during unit pressure testing prior to start-up. The fire resulted from ignition of high - pressure hydrogen-rich gas that was escaping from two shell-to-shell nozzle flanges on the hydrocracker reactor charge - effluent exchangers. Four pipefitters who were in the process of tightening the leaking flanges when the gas ignited, received first and second degree burns. The unit was depressurised to the relief system and the fire was extinguished after burning for approximately 45 minutes. Unit damage was confirmed to the insulation. The hydrocracking unit was shutdown for a scheduled regeneration of the preheater and hydrocracker reactors and minor maintenance. Following this preparations were made to bring the unit on stream. The unit was nitrogen purged and evacuated several times and nitrogen was then fed into the pretreating an hydrocracking sections checked for leaks at 100 PSIG. The nitrogen was then vented to the relief system and the system evacuated Hydrogen-rich gas was introduced and again the preheater and hydrocracker were checked for leaks up to 450 PSIG. The make-up hydrogen compressor was placed in service and the pretreater system was checked for leaks at 1250 PSIG. A moderate leak was successfully stopped. The hydrocracker section was being raised to a final test pressure of 1600 PSIG when two shell-to-shell nozzle flange leaks developed in the inner connections of the hydrocracker reactor charge-effluent exchangers. These severe leaks developed from flanges that had not been disturbed during shutdown regeneration and start-up. The make-up hydrogen compressor was shut down at about the same time due to vibration. The loss of this and the leaks caused the system pressure to fail. Four pipe-fitters were instructed to tighten the exchanger flanges using a steel maul and a steel hammer wrench. By the time the pipefitters had assumed position pressure had dropped to 1050 PSIG. At the instant the hammer wrench was struck for the second time ignition occurred. The gas in the area of both leaks flashed and continuous burning followed at both flanges. The fire extinguished itself after 45 minutes.

Probable causes of ignition were.

1. Spark caused by striking the hammer wrench
2. Static build-up from the escaping hydrogen
3. Autoignition of hydrogen due to expansion heating
4. Autoignition of iron sulphide scale.

[fire - consequence, flange leak, spark, hydrocracker, damage to equipment]

Lessons

Flange leaks are not unusual where hydrogen is circulated during start-up. It is common practice to fit known leak prone flanges with stream rings to prevent flash-fires and to heat flanges that are leaking as quickly as possible to normal process temperatures. Leaking flanges not equipped with permanent steam rings to protected with steam lances until the leak stops.

Unit operating and current maintenance practices include corrective measures:-

1. Continued use of nitrogen for evacuating and testing equipment prior to start-up; nitrogen to be used through the full range of test pressures.
2. Should major leaks occur during or after start-up with hydrogen in the system, the system pressure will be reduced to minimise leak. If a leak should continue at low pressure nitrogen will be readmitted before work is initiated.
3. Employees will wear protective clothing and equipment as required while stopping leaks occurring during and after start-up.
4. Exchanger flanges that have been opened and have leaked in the past will be tightened using hydraulic torque wrench equipment prior to pressure testing. This equipment will also be used in stopping process leaks that are found during unit start-up.

Source : HAZARDOUS CARGO BULLETIN, 1989, OCT., 84-89,; CHEMICAL WEEK, MARCH 20, 1974,; LLOYDS, FEBRUARY 20, 1973,; FIRE JOURNAL, MAY 1974.

Location : Rossville; Staten Island; New York; Usa, USA

Injured : 3 **Dead** : 40

Abstract

An explosion occurred during repair work on an empty 100,000 cubic metre liquefied natural gas (LNG) storage tank which caused the concrete roof to be blown up and fall back onto the tank. The men killed were working in the tank. Cause attributed to trapped hydrocarbons behind tank liner.
[storage tanks, fatality]

Lessons

[None Reported]

Source : ICHEME**Location :** , UK**Injured :** 21 **Dead :** 2**Abstract**

A road transportation incident. A transporter delivering liquid propane to an LPG utility plant ruptured as the result of exposure to flames from escaping burning propane. Two men were killed and twenty-one injured. Damage to propane and liquefied natural gas (LNG) operating facilities amounted to some £60,000 (1973) with about £7,000 (1973) damage to fire equipment.

The operating facilities consist of two 60,000 gallon storage tanks from which liquid propane was pumped to two integrated heated vaporisers fired with natural gas and using water as a heating medium. Propane was delivered to the plant in semi-trailer transporters, the unloading terminal catering for the discharge of two tankers simultaneously.

At 10.35 p.m., a transporter, containing some 8,500 gallons of propane was reversing into No.1 terminal when it struck and fractured part of the terminal, releasing propane vapour to atmosphere.

A second transporter with about 6,000 gallons left in the tank was unloading at a second terminal.

Despite immediate action by the control operator and the tanker driver they were unable to isolate the broken pipework before the escaping vapour was ignited by one of the vaporisers and flashed back to the leakage point preventing any further attempts to close valves.

Eleven minutes later one of the two relief valves on the second transporter lifted and some nine minutes after that the tank ruptured laterally splitting into two sections. Of the 6,500 gallons in the tank at this time (2,000 gallons having been discharged through the relief valve) approximately 3,500 gallons flash vaporised, the remainder being atomised and spraying in all directions.

The rear section of the tank flattened out but the front section remained in cylindrical form and, still attached to the tractor, was propelled forward, jack-knifing the rig and smashing against a vaporiser some thirty feet away.

The tank portion broke away from the tractor at this point and travelled some 300 ft. through the air.

At about 10.56 p.m. other piping in the process area was broken resulting in propane and LNG fires in the pump area and various structures/process buildings.

There were no automatic or remote means of closing valves in the liquid piping system.

Shortly afterwards, the valves on the storage tanks were isolated and the fire was brought under control by midnight, all fires being extinguished some two hours later. Fatality.

[damage to equipment, injury]

Lessons

Protective clothing demonstrated it's value dramatically as the extent and severity of the burns generally inversely proportional to the extent of the protection worn.

Effective application of water by hose streams in situations like this requires careful planning. Unfortunately, there had been none in this case, nor had the fire department had any training in tackling LPG fires.

Source : NORTHERN ECHO, 1973, 2 FEB.; THE TIMES, 2 FEB.

Location : Saint Amand Les Eaux, FRANCE

Injured : 40 **Dead** : 5

Abstract

A road transportation incident. During overtaking an LPG, propane, road tanker overturned in a village and ruptured releasing part of its 19 tonnes of propane. A vapour cloud explosion resulted and surrounding buildings were set on fire. The cause of the overturn was the combined braking and swerving of the trailer.

The prompt action of the driver in carrying out his

[loss of control, fire - consequence, fatality]

Lessons

[None Reported]

Source : EUROPEAN CHEMICAL NEWS, 1978, 10 DEC.; LOSS PREVENTION BULLETIN, 019, 2.

Location : Michigan, USA

Injured : 0 **Dead :** 0

Abstract

A fire retardant (PBB), firemaster, and an animals' feed supplement (magnesium oxide), neuromaster, were made at the same factory. Each product was made and bagged in their own distinctive bags. When the bags ran out brown bags were used with the names stencilled on. 2000 lbs of neuromaster were collected by an illiterate lorry driver who loaded firemaster bags by mistake. The mistake was not picked up and the PBB was fed to cattle. Extensive problems were encountered by the PBB in the food chain.

[loading, competency lacking, environmental]

Lessons

[None Reported]

Source : JOURNAL, 1972, 23 DEC.; ECHO, 1972, 28 DEC.

Location : Greatham, UK

Injured : 9 Dead : 0

Abstract

LPG leak caused explosion and fire.

[fire - consequence]

Lessons

[None Reported]

Source : COMPENDIUM OF SHIPPING INCIDENTS, 1967-1979, NO. 13.

Location : ,

Injured : 0 Dead : 0

Abstract

A marine transportation incident. Serious damage occurred on a ship's main engine thrust due to inadequate oil lubricator whilst on power. Shortly after leaving port, it was noted that the main engine lubricating oil (L.O.) temperature was abnormally high. An oil cover outlet valve was found to be barely open. This was opened and L.O. temperatures brought back to normal by the end of the watch. No comment on all this was made to the oncoming watch. Three and a half hours later the L.O. pressure to the main engine gear, had risen from 18-47 psi. The engine was slowed and discharge filters changed over. The pressure did not fall. The filters were opened and they were seen to contain traces of metal. They were cleaned and the engine pace increased. The L.O. temperature rose again. The ship proceeded to port for further investigation.

[damage to equipment, human causes, lubricating oil]

Lessons

The main turbine gearing was examined and:

1. The L.P. thrust collar pads were damaged beyond repair.
2. H.P. and L.P. primary thrust seriously damaged.
3. Main thrust ahead face serious damage.
4. Main shaft needed some re-machining.

The damage was, without doubt, worsened by continued running with insufficient lubrication. This could have been reduced, or possibly avoided if comprehensive handover information, between the two watches, had taken place.

Running at reduced speed, in confined waters and in poor weather, posed a hazard to the ship.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

At 12.45 hours on 21st November, 1972, an explosion occurred in a fired boiler followed at 15.20 hours by a second explosion when attempts were being made to relight the fuel gas burners. There were no injuries to personnel but the boiler sustained some damage.

The subsequent investigation showed that the explosions were caused by liquid LPG carryover in the fuel gas supply, from the fouling of the sight glass and subsequent failure of the refinery regasser vessel instrumentation.

The level alarm of was checked and found to be in good order (a dump valve, opening at high level, to relieve liquid to flare had been installed not long before the incident).

[instrumentation failure, damage to equipment, refining]

Lessons

Improvement of level indication and control instrumentation of the vessel. This is to be backed up by regular maintenance which in this case was insufficient.

Install check valves in the by-pass around the vessel.

Revise the operating procedure for boilers and process heaters to cope with the situation where liquid hydrocarbons may be present in the fuel gas system.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Fire on ethylene oxide unit at start-up. Failure of bellows due to overpressure of the kerosene system as a result of expansion. Operator error and relief failed to open.

[fire - consequence, overpressurisation, safety relief valve, operator error]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A leakage of motor spirit occurred from a pipeline in an urban area about 15 miles from a refinery. The line was being recommissioned following engineering modifications. At about 20.13 hours, soon after the leakage occurred it was ignited by a kerosene warning lamp hung on a protective barrier around an excavation in the vicinity of the leak. The fire was extinguished at 03.30 hours on 22nd September when the leak was stopped.

There were no injuries to personnel and only minor damage to third parties' property.

The line had been out of service for some ten days prior to the fire for the installation of insulation flanges and replacement of a flanged section of the line. The work was completed satisfactorily and the welds had been radiographed prior to acceptance. As a further check the line was pressure tested using a refinery pump since hydraulic pumps were unavailable. Several attempts were made to hold the line pressure to 750 p.s.i.g. without success and since all newly welded sections were satisfactory it was concluded that valves were passing. Previous examinations of the line during repair work had shown no signs of corrosion and leaks were not suspected.

At this time some oily water had been reported in the vicinity of the leak. Those investigating the water leak were unaware that the pressure test was being carried out. They therefore assumed that the water was coming from a leaking water main and was contaminated from lubricating oil in the ground.

Inspection of the section of the pipeline where the fire occurred revealed an external corrosion hole on the underside of the line

It was concluded that the line failure was caused by corrosion due to poor pipe laying practice.

Rocks had been placed directly against the line during back filling causing penetration of the wrapping. Road building works in the area appears to have aggravated the situation. The high water table in the area and absence of cathodic protection contributed to this corrosion attack.

[excavation damage, fire - consequence, damage to equipment, commissioning]

Lessons

1. Measures were taken to prevent excessive corrosion in future and better methods of leak detection were evaluated.
 2. In addition improved liaison between the refineries, the terminal and the local authorities were established.
-

Source : HIGHWAY ACCIDENT REPORT MULTIPLE VEHICLE COLLISION FOLLOWED BY PROPYLENE CARGO TANK EXPLOSION, NATIONAL TRANSPORTATION SAFETY BOARD, WASHINGTON D.C, USA, REPORT NUMBER NTSB HAR-73-4, 1973; EISENBERG N.A, VULNERABILITY MODEL, NATIONAL TECHNICAL INFORMATION SERVICE REPORT AD-A1025-245, SPRINGFIELD VA, 1975; HAZARDOUS CARGO BULLETIN, 1984, SEP., 39-41.

Location : New Jersey, USA

Injured : 28 **Dead :** 2

Abstract

A road transportation incident. A road tanker carrying propylene liquid petroleum gas (LPG) sideswiped an empty bus. The tanker then overrode the median guard rail, jack knifed, and overturned. Fire, caused by friction sparks when the road tanker scraped the median guard rail, ignited fuel escaping from the tractor's left side fuel tank and spread to propylene which was leaking from the tankers damaged plumbing, enveloping a large part of the cargo tank flame. Approximately 25 minutes after the crash, the cargo tank exploded. Fatality.

[fire - consequence, spark]

Lessons

[None Reported]

Source : ICHEME

Location : , Gulf Of Asia

Injured : 0 Dead : 0

Abstract

An incident occurred at approximately 08.40 hours on 18th September, 1972, when two cranes were engaged in raising and turning a damaged LPG storage sphere. The jib of one crane collapsed sideways and extensive damage was caused to the centre section of the jib and the drum brake mechanism. There were no injuries to personnel on this occasion.

The two cranes had satisfactorily lifted the sphere on the previous day and prior to commencing lifting operations each crane had been inspected and had satisfactorily lifted a test load of 40 tonnes.

[storage tanks, damage to equipment]

Lessons

[None Reported]

Source : CHEMICAL WEEK, 1972, 13 SEP.

Location : Brazosport, USA

Injured : 7 **Dead** : 2

Abstract

Explosion in isoprene derivative plant. Fatality.

Lessons

[None Reported]

Source : ICHEME**Location :** , NIGERIA**Injured :** 0 **Dead :** 0

Abstract

Marine transport. A serious fire broke out at a wharf, in the early hours of the morning of 27th August 1972, while a marine tanker was discharging premium motor spirit.

Since each installation had a separate line system, frequent hose changing was a necessity. Owing to a desire to minimise delay, hose change-over was carried out too rapidly so that the hose string was not fully drained before the flanges were completely uncoupled with the result that a quantity of motor spirit was spilled. The spirit flowed over the wharf floor and into the water where it was ignited almost certainly by a canoe, equipped with a naked kerosene lamp, illegally fishing under the wharf structure.

The wharf was immediately enveloped in flames and the crew of the tanker commenced fighting the fire with foam from the ship's appliances. The local fire brigade and a fire float arrived within 30 minutes, as did firemen from the nearby storage installation.

However, by this time the tanker's crew, who had responded promptly and efficiently, had the fire under control.

No-one was hurt but the damage to the wharf facilities, mainly destroyed oil hoses. In addition a large area of paintwork (30,000 sq. ft.) on the tanker was severely scorched.

This accident was basically caused by unsafe working procedures combined with poor security.

[fire - consequence, human causes, petrol, damage to equipment, unloading, gasoline]

Lessons

Strengthen security arrangements, provide better fire fighting facilities and improve the training of wharf personnel.

Issue strict instructions regarding hose change-over procedures.

671 08 August 1972

Source : OIL PAINT AND DRUG REPORTER, 1972, 21 AUG.; EUROPEAN CHEMICAL NEWS, 1972, 25 AUG.; CHEMICAL WEEK 16-3-72

Location : Los Angeles; California, USA

Injured : 0 **Dead** : 0

Abstract

Tank farm fire following pipe fracture. 21 out of 73 tanks destroyed. Tank was 6.1 m diameter and 18.3 m high and 534 cum (cubic metres) capacity. The fire lasted 4 hours and the loss was \$1.47 million (1972) at 1992 values. Substances involved: acetone, glycols, ketones, perchloroethylene, vinyl acetate. [storage tanks]

Lessons

[None Reported]

Source : ICHEME

Location : , GULF OF PERSIA

Injured : 8 Dead : 0

Abstract

At 08.30 hours on 21st June, 1972, whilst repairs were being carried out to the legs of a propane storage sphere, four of the six legs of the vessel fractured completely and the sphere collapsed.

Three small fires occurred when pipework between the vessel and the nearby pipetrack was fractured. A cloud of LPG vapour formed over the pipetrack and was ignited, probably by broken welding leads.

One welder sustained multiple bruises and seven other employees had minor injuries or suffered slight gassing while escaping over the bund dividing wall.

Earlier in the year, the sphere had been taken out of service to allow its cocks to be serviced. At that time it was gas freed, by filling with water, drained, and the cocks removed for overhaul. It was noticed at that time that some of the fireproofing on the legs was badly cracked.

On removal of the fireproofing, corroded areas were found and it was decided to fit welded sleeves of 1/4" mild steel plate over specified lengths of each leg.

The sleeves were fabricated and clamped in position.

Prior to commencement of welding the vessel was again filled with water and left full to ensure gas-free conditions. Welding was being carried out simultaneously at four of the support legs when the sphere began to rock and then fell slowly to the ground. The sphere itself was badly dented but intact.

Following the collapse, the foundation levels were checked and it was found that one leg foundation block was 90 mm lower than the two adjacent foundation blocks. Although the spheres were designed to withstand a hydrostatic test at the construction stage, the deterioration of the support legs over a number of years had reduced their load bearing capacity and they were no longer capable of this duty.

[fire - consequence, spark, injury]

Lessons

When filling equipment with water it is important to remember that the density of water is high compared with most petroleum products and that many vessels do not even operate full of oil.

Whenever vessels, columns, etc., are to be filled with water then prior inspection of their supports should be made to ascertain that there is no structural wastage.

Source : ICHEME. 100 LARGEST LOSSES 9TH EDITION, MARSH & MCLENNAN PROTECTION CONSULTANTS LTD, 1986

Location : Duque de Caxias, Rio De Janeiro, BRAZIL

Injured : 37 **Dead :** 37

Abstract

Thirty-seven people were killed and the same number injured as a result of an explosion and fire at a Refinery. Damage was estimated at £3,500,000 (1973). LPG storage tanks built in 1961 were equipped with only two valves, a relief valve at the top for venting excess gas and a block valve at the bottom for draining water.

The block valve was designed to close automatically when water had finished draining. Although it was not felt necessary to improve the safety measures during the intervening years, a dangerous situation could have arisen, if, due to malfunction of the valve, LPG was allowed to drain out. The valve could then become frozen by the evaporation of the liquid gas passing through it. At the time of the incident, a byproduct from a rubber plant was being transferred to a spherical container for temporary storage. Since it was a relatively high temperature, the internal pressure of the sphere rose rapidly above the safe working pressure. The relief valve failed to operate and since, after the explosion, the valve was never found, the cause of failure could not be established.

It is therefore possible that noting the increasing pressure, an attempt was made to reduce the pressure by draining the water. Since only a small quantity of water was present, LPG was expelled, which froze the valve and prevented it closing. The gas continued to escape increasing in quantity and spreading through the whole area with the disastrous result mentioned above. Fatality.

[valve failure, leak, refining, fire - consequence, injury]

Lessons

This incident is similar to the Feyzin disaster in France several years ago (see record 339) The report at the time made a number of recommendations:

1. Good practice for water draining is to drain via a de-watering pot in which a level of water is always maintained, as shown in the sight glass, so that no LPG can escape at the drain.
 2. In any case, whether or not a de-watering pot is fitted, two valves must be operated in the drain line. First, open the upstream valve. They should be opened at 2 ft. apart. In this way, freezing of the upstream valve is very unlikely.
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Source : HIGHWAY ACCIDENT REPORT PROPANE TRACTOR SEMITRAILER OVERTURN AND FIRE, NATIONAL TRANSPORTATION SAFETY BOARD, WASHINGTON D.C, USA, REPORT NUMBER NTSB-HAR-73-3, 1973; EISENBERG N.A, VULNERABILITY MODEL, NATIONAL TECHNICAL INFORMATION SERVICE REPORT AD-A1025-245. SPRINGFIELD VA., 1975.

Location : Lynchburg; Virginia, USA

Injured : 5 **Dead** : 2

Abstract

A road transportation incident. A tanker carrying LPG overturned, slid along the road and hit a rock embankment puncturing the tank. A vapour cloud formed, expanded and then ignited into a fireball. The cause was attributed to the driver driving on the wrong side of the road and quickly correcting the error. Contributing to the error was misleading traffic signs and high centre of gravity of the tanker. Fatality.

[driver error]

Lessons

[None Reported]

Source : RAILROAD ACCIDENT REPORT HAZARDOUS MATERIALS RAILROAD ACCIDENT, NATIONAL TRANSPORTATION SAFETY BOARD, WASHINGTON D.C, USA, REPORT NUMBER NTSB-RAR-73-1, 1973; EISENBERG N.A, VULNERABILITY MODEL, NATIONAL TECHNICAL INFORMATION SERVICE REPORT AD-A1025-245, SPRINGFIELD VA, 1975

Location : St Louis; Illinois, USA

Injured : 250 **Dead** : 1

Abstract

A rail transportation incident. A speeding rail tanker loaded with LPG was in collision with a standing hopper car. In the impact an overriding coupler on the empty freight car punctured the tank head. The pressured propylene gas in the tank car leaked to the ground and vaporised. A large vapour cloud was formed, which ignited and exploded. The probable cause of the impact was failure of the retarding system in the yard to decelerate heavy cars with oil or grease on their wheel rims; the absence of a backup system to halt cars passing through retarders at speed and the acceptance at the yard of uncontrolled speeding. Propylene leaked from the tank car because the tank head was too weak to resist the impact of the overriding coupler of the hopper car. Lack of specifications that define permission impact and adequate crash resistance was a contributing factor.

[explosion, fatality]

Lessons

[None Reported]

Source : ICHEME**Location :** ,**Injured :** 0 **Dead :** 0

Abstract

At 09.30 hours an operator saw vapour escaping at high level, on the crude unit side-stream strippers. Shortly afterwards this vapour ignited and a prolonged fire ensued which necessitated taking the unit off stream. The fire had begun as a result of a drain line unblocking itself and allowing hot kerosene from the kerosene side-stream stripper to escape into the surrounding area.

The ignition source was not established but it was probably due to the flammable mixture of air and vapour contacting a hot metal surface in the plant. Nobody was injured in the incident but damage to plant was estimated at £15,000 (1972) and there were three days of lost production.

Sometime before the fire, operators had been having problems with the level control system of the strippers and the float chamber and sight glass gauges had been drained on several occasions.

Difficulty in moving drain valves was experienced due to low ambient conditions causing freeze-up, and it is believed that one of these valves was not fully closed. Oil leakage had not occurred before the incident because of frozen condensate in the line but a steam hose placed nearby probably provided sufficient heat to thaw out the ice block allowing the kerosene to be released to atmosphere.

The Refinery Fire Service arrived two minutes after the outbreak and provided cooling water to exposed plant and equipment until the fire finally went out due to lack of fuel. The position of the leak, approximately 70 feet above the ground made extinction at an earlier stage potentially more hazardous than allowing the fire to burn under control. The extremely low temperature at the time, minus 5 degrees C with an easterly wind, undoubtedly contributed towards the incident since then, insulation and heating have been provided for level float pots and sight glasses where necessary in the refinery.

Most of the damage occurred in the immediate vicinity of the leaking drain, the pneumatic transmitter was destroyed by the fire as also were electric cables and instrument lines. The sight glasses of the kerosene stripper although cracked by the heat remained in position and thus prevented the fire being worse than it was.

Galvanised corrugated cladding had warped slightly over an area of approximately 4 sq. metres but remained intact as did the galvanised underlying insulating glass wool.

[hot surface, fire - consequence, damage to equipment, separation equipment, cold weather, freezing]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A high wall surrounding an LPG cylinder storage depot collapsed, crushing some 12 kg LPG cylinders, and causing a large quantity of gas to escape. The escaping gas collected between the remaining wall and the nearby office buildings. In the meantime site personnel attempted to cut off the supply of electricity to the office building, but it is doubtful whether this was successful before the fire broke out. Three explosions occurred within the building, the gas ignited and some of the cylinders exploded, scattering fragments over a distance of 100 metres. After about two hours the fire was brought under control, and extinguished.

The source of ignition is not known, but it may have been caused by an electrical spark from the office building or from a car which reportedly disregarded the "No Entry" sign.

Although the LPG installation was equipped with a hydrant system, no apparent effort was made to operate the system when the escaping gas was first detected, neither was there any attempt to cool the cylinders.

[gas / vapour release, fire - consequence, reactors and reaction equipment]

Lessons

The primary cause of this incident was the badly constructed wall. However, it illustrates that in the event of an LPG fire, it is important to keep the cylinders or tanks cool to prevent heat rupture.

The layout of the depot would also appear to have been a contributory factor in that the safety distance to the office building was inadequate. Moreover, LPG or other volatile products should be stored under conditions of good ventilation to reduce the likelihood of accumulation of gas or vapours.

Source : ICHEME

Location : , TURKEY

Injured : 0 Dead : 1

Abstract

A road transportation incident. At a service station in Southern Turkey a road tanker arrived late at night to deliver product. The driver awoke the night attendant who lit a kerosene lamp and then started the generator. The driver connected the hose to the underground tank and then went to sleep. After a while the night attendant climbed onto the tanker with the lantern in his hand to check the product level in the compartment. To illuminate the liquid level better he lowered the lantern through the manhole into the compartment. The tanker exploded and caught fire, the flames enveloping the forecourt and the office building. The attendant was fatally injured and died on his way to hospital. The fire was extinguished after 1.5 hours but not before the road tanker was completely burned out and extensive damage was done to the service station.

[fire - consequence, fatality, damage to equipment, human causes]

Lessons

Train service station staff.

114221972

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

With ambient temperatures down to -12 degrees C, a tank was being finally topped up for winter. A routine early morning inspection found gas leaking from cracked crown top plate. Examination determined that the liquefied natural gas (LNG) fill isolation valve was leaking at the gland at the rate of a small drip approximately every 30 seconds. This was sufficient to generate a crack approximately 750mm long with three smaller cracks running from it. In this instance the leak of LNG was so small as not to be visible except by close examination. The leak of gas was at virtually ambient temperature, thus there was no condensation of atmospheric moisture, and again was only discoverable by close examination. The gas leakage rate was not sufficient to effect the operation of the associated boil off compressors.

[valve failure, gas / vapour release]

Lessons

[None Reported]
