

1322114 December 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, DECEMBER 15, 2000, (<http://www.chemsafety.gov>).

Location : Woodlawn, Ohio, USA

Injured : 0 **Dead** : 0

Abstract

One hundred and fifty people were evacuated when a hydrochloric acid spilled during preparations for offloading. The incident occurred when a flange on a road tanker broke spilling several hundred gallons of acid. Fortunately no one was injured in the incident.

[evacuation, unloading, flange failure]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, NOVEMBER 3, 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 : New Brunswick, CANADA

Injured : 2 **Dead :** 0

Abstract

An explosion occurred when welding sparks ignited gases released from a vacuum truck. Two welders were injured in the incident.

[burns, injury]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A fire occurred at a chemical plant. An investigation into the incident found that a line below a valve on the pumping pot was leaking severely and had spilled onto the wooden base of a stapling machine, which then caught fire.

The pipework around the leak was stripped revealing no fractures, the diaphragm valve was not damaged either.

It was therefore concluded that the leak occurred due to the failure of one of the polyethylene gaskets.

[fire - consequence, gasket failure]

Lessons

[None Reported]

13209October 2000

Source : CNN.COM, DECEMBER 11, 2000, (<http://www.cnn.com>).

Location : South Carolina, USA

Injured : 0 **Dead** : 0

Abstract

A crack has been found in a pipe at a nuclear power plant. A 2.7-inch tear occurred along a weld seam on the pipe, which carries scalding contaminated water from a nuclear reactor core. Approximately 100 pounds of boric acid spilled. It has been reported that there has been no threat to the environment. An investigation into the incident is underway.

[material transfer, weld failure, reactors and reaction equipment]

Lessons

[None Reported]

Source : BBC NEWS, 13 SEPTEMBER, 2000, (<http://www.bbc.co.uk>).

Location : , UK

Injured : 0 Dead : 0

Abstract

A fire occurred at in a fuel storage tank containing 30,000 litres of central heating oil. It is thought that the fire occurred due to a faulty thermostat.
[fire - consequence, instrumentation failure, storage tanks]

Lessons

[None Reported]

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

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Location : Willoughby, USA

Injured : 1 **Dead :** 0

Abstract

A series of explosions and fires occurred at a plant. The explosion was caused by a spark or static electricity, which ignited gas leaking from overfilled cylinders. One person was injured in the incident.

An investigation found that an estimated 900 of 1,1000 cylinders were leaking from safety relief valves. The building was evacuated.

[burns, fire - consequence, overflow, evacuation, injury]

Lessons

[None Reported]

1283916 July 2000

Source : BBC NEWS, 18 JULY, 2000, (<http://www.bbc.co.uk>).

Location : Curitiba, BRAZIL

Injured : 0 Dead : 0

Abstract

At least four million litres of crude oil leaked from an underwater pipeline at a refinery into a nearby river.

The incident occurred when the pipeline ruptured spilling the crude for up to two hours into the river.

More than thirty floating barriers have been set up to try to contain the spill and to vacuum the oil off the surface.

The company has been fined \$100m (2000).

[pipeline failure, environmental, ecological damage]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, AUGUST 1, 2000, (<http://www.chemsafety.gov>).

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Location : Lawrence, USA

Injured : 0 **Dead :** 0

Abstract

An explosion / pressure release occurred whilst bringing a plant on line at an industrial plant involving several occurrences.

The incident occurred when a compressor malfunctioned approximately an hour later the auxiliary boiler malfunctioned, releasing ammonia to atmosphere.

A few hours later a third malfunction occurred when workers again were trying to bring the plant back online when a gasket blew and ignited hydrogen causing an explosion / pressure release.

[see record 12930 for second explosion at the same plant] [gasket failure, gas / vapour release]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, JULY 12, 2000. (<http://www.chemsafety.gov>).

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Location : Lancaster, USA

Injured : 2 **Dead :** 0

Abstract

An explosion occurred at a food packaging plant releasing ammonia into the atmosphere. A worker was seriously burned and a nearby resident affected by the fumes. The building was evacuated.

It is thought that a flange on an air compressor failed causing the safety valve to fly off releasing ammonia. The ammonia may have mixed with oil in the workshop area resulting in the explosion.

The fire started by the explosion was extinguished and the leak stopped within minutes.

[gas / vapour release, burns, fire - consequence, flange failure, injury]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, JUNE 30, 2000, (<http://www.chemsafety.gov>).

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Location : Jiangman City, CHINA

Injured : 160+ **Dead** : 36

Abstract

A fire and explosion occurred at a fireworks factory. An estimated thirty six people have been killed and so far one hundred and sixty injured. The report stated that the fire started just as workers were arriving to begin their workday.

It is thought that the explosion was caused by sparks made by workers pounding iron nails.

[fire - consequence, fatality, injury]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, JUNE 15, 2000, (<http://www.chemsafety.gov>).

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Location : Blue Ash, USA

Injured : 6 **Dead :** 0

Abstract

A flash fire was triggered when a hydraulic fluid leak occurred near a series of electrical switches.

The incident occurred when a worker dropped a mold used in the manufacturing process, the mold hit the hydraulic fluid line causing it to spring a leak. Six workers were affected by smoke.

Slight damage occurred to equipment.

[fire - consequence, flashover, damage to equipment, injury]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, JUNE 15, 2000, (<http://www.chemsafety.gov>).

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Location : South Elgin, USA

Injured : 2 **Dead :** 0

Abstract

Approximately 15 to 20 gallons of nitric and sulphuric acid spilled at a metal finishing company when a valve between a tanker truck and a building malfunctioned. Two workers including the driver were affected by the release.

The spill affected approximately 400 square feet.

Heavy rain at the time of the spill diluted the chemicals.

Nearby buildings were evacuated as a precaution.

[nitric acid, evacuation, valve failure, material transfer, injury]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, MAY 31, 2000, (<http://www.chemsafety.gov>)

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Location : Ontario, CANADA

Injured : 0 **Dead :** 0

Abstract

A 42-inch pipeline ruptured releasing natural gas. The incident occurred during pressure testing. The gas was quickly turned off and there was no danger to the environment.

[pipeline failure, near miss]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, MAY 31, 2000, (<http://www.chemsafety.gov>).

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Location : Akron, USA

Injured : 3 **Dead :** 0

Abstract

A fire and explosion occurred three days after an explosion that injured two people. Three workers suffered serious burns.

The incident occurred, as workers were mixing chemicals in a large vat. The force of the explosion blew out a cement wall and caused a fire, which was quickly extinguished.

Damage is estimated at more than \$1 million (2000).

It is thought that sparks from a passing forlift truck triggered the explosion.

[fire - consequence, unknown chemicals, injury]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, MAY 26, 2000, (<http://www.chemsafety.gov>)

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Location : Phoenix, Arizona, USA

Injured : 2 **Dead :** 0

Abstract

A hazardous chemical leak occurred at a plastics company forcing the evacuation of 150 people from the building and nearby businesses.

Approximately 75 gallons of 2-ethyl-2-oxoline, a highly flammable chemical used in the production of plastics that can cause respiratory and skin irritation, leaked on to the floor. The material has a flash point of 84 degrees C.

The incident occurred as employees were transferring the chemical from one tank to another when a valve stuck open. Due to the tank having a retention base around it, the leak was contained.

The chemical was absorbed with a product called vermiculite and transferred to other drums.

Fumes affected two employees.

[processing, gas / vapour release, material transfer, valve failure, injury]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 25 APRIL, 2000, (<http://www.chemsafety.gov>),

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Location : Martinez, California, USA**Injured :** 2 **Dead :** 0**Abstract**

A fire occurred at a refinery when fire fighting water became contaminated with fuel. An investigation into the incident found a small leak in a closed valve that is meant to separate the fire fighting water used to wash out fuel processing vessels.

Four other valves were meant to serve as backup devices to prevent contaminated water from flowing backward into the fire fighting water. But three were stuck in the open position and the fourth one had a broken spring.

The incident occurred when the fire fighting water was sprayed underneath a welding job to quickly extinguish sparks that might ignite any stray vapours from refining units. But the water released a cloud of gas that burst into flames. The worker holding the hose and the welder suffered burns in the fire.

[fire - consequence, contamination, mechanical equipment failure, injury]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 24 MARCH, 2000, (<http://www.chemsafety.gov>).

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Location : Grand Prairie, CANADA

Injured : 0 **Dead :** 0

Abstract

An explosion occurred during welding operations on a tanker truck. The incident occurred when sparks ignited leftover fumes after the tanker had been emptied of its load of flammable oil well service water.

The explosion blew a hole 8 metres in diameter through the sheet metal roof and dented three overhead garage doors. Fortunately no one was injured in the incident.

Damage was estimated at \$350,000 (2000) to the building and \$70,000 (2000) to the truck.

[road transport, damage to equipment]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 22 MARCH, 2000, (<http://www.chemsafety.gov>).

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Location : Igongwe, TANZANIA

Injured : 40+ **Dead** : 28+

Abstract

A road transportation incident. A fuel tanker overturned and caught fire. The fire occurred when residents in the area rushed to the scene to extract fuel from the overturned tanker, but in the process tampered with the battery, which sparked off the fire.

[fire - consequence, fatality, sabotage, injury]

Lessons

[None Reported]

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

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Location : Lat Krabang, THAILAND

Injured : 1+ **Dead :** 1

Abstract

An explosion occurred at a petrol station when an oil tanker was offloading its cargo caught fire. Severe damage occurred to the surrounding area.

It is thought that a spark from an oil pump may have caused the fire and explosion.

[road transport, unloading, fire - consequence, fatality, burns]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 10 MARCH, 2000, (<http://www.chemsafety.gov>).

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Location : Tampico, MEXICO

Injured : 31 **Dead** : 0

Abstract

A propane tank exploded injuring 31 people and causing damage to equipment. The injured suffered burns.

The cause of the explosion was due to an electrical short near to the tank, which was leaking at the time.

[explosion, short circuit, fire - consequence, injury]

Lessons

[None Reported]

1225308 March 2000

Source : CNI NEWS, 8 MARCH, 2000, (<http://www.cnionline.com>).

Location : Rayong, SINGAPORE

Injured : 200+ Dead : 1

Abstract

A 50,000-tonne/year polycarbonate plant was shutdown after a leak of carbonyl chloride gas or phosgene occurred.

One person was killed and approximately 200 workers and residents needed hospital treatment for breathing problems, one worker was critical.

The incident occurred after the leak was detected issuing from a fractured pipe, the gas then travelled through the plant's ventilator system and was released into the atmosphere surrounding the building and nearby residential areas.

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

[plant shutdown, processing, fatality, injury]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 9 MARCH, 2000. (<http://www.chemsafety.gov>).

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Location : Rayong Province, THAILAND**Injured** : 92 **Dead** : 1**Abstract**

Toxic carbonyl chloride (phosgene fumes leaked from a fractured pipe affecting 200 factory workers and nearby residents. One worker died and two were critically injured in the incident.

More than 80 people were taken to hospital for treatment for breathing difficulties, nausea and eye irritations.

[gas / vapour release, fatality, injury]

Lessons

[None Reported]

12768 March 2000

Source : CHEMICAL HAZARDS IN INDUSTRY, JUNE 2000.; OCCUPATIONAL HAZARDS, APR 2000, 62(4), 24.

Location : Westchester, USA

Injured : 0 Dead : 0

Abstract

A small crack was discovered in a tube on a nuclear plant that caused a small amount of radioactive steam to enter the atmosphere. Radioactive water leaked from the cracked reactor and contaminated clean water used to drive turbines.

The crack was discovered using a remote-controlled device with attached video camera.

The plant will remain out of service for several weeks.

[gas / vapour release, contamination, reactors and reaction equipment]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, FEBRUARY 19, 2000. (<http://www.chemsafety.gov>).

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Location : Bristol, UK

Injured : 5 **Dead :** 0

Abstract

An explosion occurred when a construction worker accidentally cut through a gas pipe carrying an unspecified substance.

A spark from the disk cutter triggered the explosion injuring the construction worker and four other workers.

[hot work, injury]

Lessons

[None Reported]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, FEBRUARY 1, 2000. (<http://www.chemsafety.gov>).

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Location : , USA

Injured : 1 **Dead :** 0

Abstract

A fire and explosion occurred at a refinery on two separate days. The first to occur was an explosion, which slightly injured a worker and badly damaged a platformer.

The fire occurred about a week later and involved a vacuum that feeds into the plant's fluid catalytic cracking unit. Approximately 130 gallons of crude oil had caught fire.

The fire was put out within minutes using hand-held fire extinguishers.

It is thought that a fractured steam line caused the fire.

[fire - consequence, damage to equipment, injury]

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]

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, JANUARY 12, 2000, (<http://www.chemsafety.gov>).

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Location : , USA

Injured : 0 **Dead :** 0

Abstract

An explosion and fire occurred on a building under construction. The incident occurred when a propane tank rusted through and leaked propane into a heating unit used to dry drywall. Nearby, approximately 20 propane tanks were in danger of exploding. Damage was estimated at \$35,000 to \$40,000 (2000).

[fire - consequence, damage to equipment, spill, corrosion, heating equipment]

Lessons

[None Reported]

Source : HAZARDOUS CARBO BULLETIN, JUNE 2000.

Location : Ohio, USA

Injured : 0 Dead : 0

Abstract

A catastrophic failure of a storage tank occurred causing the release of approximately one million gallons of fertiliser into the environment. The most likely cause of the failure is thought to be due to weld failure. Four adjacent tanks were damaged by the outflow of the product.

An estimated 3,300m³ of product was spilt into a nearby river; the remainder was contained in bunds.

[tank failure, spill, pollution, damage to equipment, storage tanks]

Lessons

[None Reported]

122302000

Source : THE ENGINEER, 27 OCTOBER 2000.

Location : , UK

Injured : 0 Dead : 0

Abstract

A marine transport incident. Twelve nuclear submarines were taken out of service as a precaution when cracks were found in the reactor cooler system of one submarine.

Checks are being carried out to determine whether this incident could occur on the other eleven submarines.

[reactors and reaction equipment, near miss, radioactive, marine transportation]

Lessons

[None Reported]

7995 03 December 1999

Source : BBC NEWS, DECEMBER 3, 1999, (<http://www.bbc.co.uk>); CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, FEBRUARY 4, 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 : , THAILAND

Injured : 15 **Dead** : 7

Abstract

A fire occurred after an explosion at an oil refinery which killed two people and injured fifteen.

The explosion and fire caused between US\$23m-27m (1999) damage.

Four out of the nine oil tanks exploded. The force of the explosion was felt in nearby towns and several kilometres away.

Thirty million litres of petrol stored in the four burned-out tanks was destroyed in the blaze.

It is thought that the explosion occurred after the storage tanks were overfilled and that a spark may have ignited the vapour.

[burns, fire - consequence, refining, damage to equipment, fatality, injury]

Lessons

[None Reported]

1237224 November 1999

Source : CHEMICAL HAZARDS IN INDUSTRY, MARCH 2000,; FIRE PREVENTION, JAN 2000, (328), 6.

Location : , USA

Injured : 0 Dead : 1

Abstract

An explosion occurred at a tyre plant when a spark ignited a spill of heptol. An area of one square mile around the plant was evacuated as a precaution as there was a threat of further explosions.

One worker was killed in the explosion.

[leak, evacuation, fatality]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, JANUARY 2000.

Location : Milwaukee, USA

Injured : 0 **Dead :** 0

Abstract

A rail transportation incident. A 144-car freight train derailed due to a worn wheel bearing. An uncertain amount of acid leaked from one car carrying 5.5 tonnes of product. A nearby residential area was evacuated.

[derailment - consequence, bearing failure, spill, evacuation]

Lessons

[None Reported]

Source : YAHOO NEWS UK & IRELAND, SEPTEMBER 3, 1999, (<http://www.yahoo.co.uk>).

Location : , UK

Injured : 31 Dead : 0

Abstract

Thirty one workers were sent to hospital suffering breathing problems and nausea after a chemical leak at a warehouse. The workers were under observation after formaldehyde escapes from a container at the warehouse.

It is thought that a forklift truck punctured a container in a chemical handling area.

[gas / vapour release, warehousing, fracture, operator error, people]

Lessons

[None Reported]

12094September 1999

Source : CHEMICAL HAZARDS IN INDUSTRY, DECEMBER 1999,; CHEM. WEEK, 29 SEP 1999, 161(36).

Location : Moscow, RUSSIA

Injured : 4 **Dead** : 9

Abstract

A fire occurred at a plastics warehouse killing nine workers and causing serious burns to four others. It is thought that the cause of the incident was due to a spark from faulty welding equipment.

[fire - consequence, fatality, injury]

Lessons

[None Reported]

1164515 August 1999

Source : CNN.COM, U.S. NEWS, AUGUST 16, 1999, (<http://www.cnn.com>); HAZARDOUS CARGO BULLETIN, NOVEMBER 1999.

Location : North Carolina, USA

Injured : 2 Dead : 0

Abstract

A break in a pipeline sent a yellowish cloud of toxic chemicals into the air above a pharmaceutical plant causing the evacuation of a nearby trailer park. Two workers were injured when the pipeline broke, releasing approximately 400 gallons of bromine, one suffered burns and the other complained of respiratory problems. Both were under observation at hospital. Approximately seventy five people were evacuated. Much of the bromine released was in liquid form and was contained, though some formed a cloud.

[gas / vapour release, pipeline failure, processing, evacuation, injury]

Lessons

Bromine, a chemical that can cause severe injury or death when inhaled, ingested or after coming into skin contact

122212 August 1999

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

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Location : , USA

Injured : 11 **Dead :** 0

Abstract

A chemical explosion occurred at a nuclear weapons plant. The incident occurred during cleaning operations when the impact of a metal tool on a shock-sensitive mixture of potassium-superoxide and mineral oil ignited. Eleven workers were injured; three of the workers were treated for burns and smoke inhalation.

The workers were removing an old crucible used in casting nuclear weapons parts at the time of the incident.

[spark, tools & access equipment, injury]

Lessons

[None Reported]

1175803 August 1999

Source : BBC NEWS, 3 AUGUST, 1999, (<http://www.bbc.co.uk>).

Location : , UK

Injured : 100+ Dead : 0

Abstract

More than one hundred children were taken to hospital after a chlorine leak at a swimming pool. The swimming pool was immediately evacuated. It is thought that a faulty pump is to blame.

[people, evacuation, pump failure, leak, spill, gas / vapour release]

Lessons

[None Reported]

1288927 July 1999

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A relief valve on a HF alkylation unit acid settler failed to operate under overpressure during an emergency shutdown of all process units following a power failure.

A subsequent release of hazardous materials occurred.

[valve failure, overpressurisation, gas / vapour release, damage to equipment, power supply failure, processing, chemicals unknown]

Lessons

[None Reported]

Source : CNN.COM, U.S. NEWS, 30 JUNE, 1999,
(<http://www.cnn.com>).

Location : Tennessee, USA

Injured : 1 **Dead :** 2

Abstract

Two welders working on a supposedly empty crude oil storage tank near an oil field were killed when the tank exploded, a third worker was air lifted to hospital. People in nearby houses were evacuated.

The fire that followed the explosion was brought under control in half an hour.

It is thought that a spark ignited the explosion, an investigation is underway.

[welding, storage tanks, fire - consequence, evacuation, fatality, injury]

Lessons

[None Reported]

11876May 1999

Source : CHEMICAL HAZARDS IN INDUSTRY, SEPTEMBER 1999.

Location : , USA

Injured : 0 Dead : 0

Abstract

A fire occurred at a plant causing damage of £1 million (1999). The incident occurred whilst toluene was being transferred from a 10,000 gallon tank to a 55 gallon drum. A spark caused a flash fire. Approximately 1000 gallons of toluene were spilled.
[fire - consequence, damage to equipment, drums, material transfer]

Lessons

[None Reported]

12497May 1999

Source : EVENING CHRONICLE, 21 MAY, 1999, (<http://www.evening-chronicle.co.uk>)

Location : Tynside, UK

Injured : 2 **Dead** : 1

Abstract

An explosion occurred at a factory killing a worker and injuring two others. At the time of the incident repair work was being carried out on a press heat exchanger when a filter blocked. It is thought that due to the filter being blocked a pipe fracture occurred resulting in a massive release of high-pressure steam. An investigation is underway into the cause of the explosion.

[burns, fatality, flow restriction, injury]

Lessons

[None Reported]

12100February 1999

Source : CHEMICAL HAZARDS IN INDUSTRY, DECEMBER 1999,; SAF. MANAGE. (LONDON), OCT 1999, 31.

Location : , UK

Injured : 2 Dead : 0

Abstract

A company was fined £2500 (1999), following an incident in which two employees suffered burns to their hands and faces whilst using solvent to strip paint off the inside of a boat hull. A spark from an electric sander ignited flammable vapour inside the boat.
[vapour cloud explosion, injury, tools & access equipment]

Lessons

The report stated that the company failed to ensure that the hull was properly ventilated. The incident could have been prevented by using an extractor fan to remove solvent vapour.

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

Location : , UK

Injured : 0 Dead : 0

Abstract

A road transportation incident. A lorry carrying a skip loaded with car batteries was stopped by police when clear liquid had been seen escaping from the back of the vehicle.

It was found that the liquid was battery acid, which was leaking from the skip.

A sample of the liquid pouring from the skip showed it to be highly acidic, with a pH value of less than 1. The company was fined £7,000 and costs of £1,1865 (2000).

[spill, human causes, corrosion]

Lessons

[None Reported]

110331999

Source : CHEMICAL HAZARDS IN INDUSTRY, JUNE, 1999, ISSN 0265-5271.; ENDS REPORT, FEB 1999, (289), 5-6.

Location : , UK

Injured : 0 Dead : 0

Abstract

A leak of hydrochloric acid occurred at a site. The area contains a Greenabella Marsh bird and is a roosting and feeding site for wading birds. Acid contaminated over half of the marsh.

The leak was from a fractured underground pipeline taking waste to storage lagoons.

[pollution, ecological damage, material transfer]

Lessons

[None Reported]

128871999

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A fire occurred in a vacuum bottoms tank when the roof weld joint failed spilling hot oil in the surrounding dike/bund.

The most probably cause of the weld failure was due to a minor internal explosion or overpressure due to the ignition of flammable vapour by pyrophoric deposits. The tank contents were at an unusually high temperature at the time.

[fire - consequence, overpressurisation, oil - hot]

Lessons

[None Reported]

1045714 December 1998

Source : BBC ONLINE NETWORK, 1998,
(<http://www.bbc.co.uk>).

Location : , CHINA

Injured : 10 **Dead :** 32+

Abstract

An explosion occurred in a coal mine killing at least 32 miners and injured 10. The explosion was caused by a spark, which ignited coal gas.
[vapour cloud explosion, injury, mining]

Lessons

[None Reported]

1260309 December 1998

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

Location : Wales, UK

Injured : 0 Dead : 0

Abstract

A spillage of approximately 20 tonnes of hydrochloric acid occurred and an unauthorised discharge of mercury into a nearby estuary.

The incident occurred when a tank flange failed on a 150 tonne storage tank containing acid. The tank contained only 40 tonnes at the time of the incident, half of which was quickly discharged into a nearby road tanker.

The 20 tonne spillage generated a gas cloud, which required dousing with water to minimise its off-site impact.

The bund containing the tank breached after 30 minutes and allowed diluted acid to spill into the surface water systems that were contaminated with mercury.

The acid mobilised the mercury and one third of a kilogram was discharged into the estuary.

The cause of the incident was due to completely inadequate procedures for maintenance and inspection of plant and equipment.

The company was fined £21,000 and costs of £17,950 (2000).

[flange failure, storage tanks, gas / vapour release, environmental, ecological damage, human causes]

Lessons

Mercury is highly toxic and cumulative poison, which in the environment continues to be recycled within living plants and animals.

After the investigation the following was addressed to ensure compliance with IPC authorisation:

1. To ensure the tank farm bund was acid resistant.
 2. To review the integrity of effluent drains on site.
 3. To review the location and performance of environmental acid gas detectors.
 4. Review the best available techniques for monitoring tank levels on site.
-

10787December 1998

Source : BBC ONLINE NETWORK, (<http://www.bbc.co.uk>).

Location : , USA

Injured : 0 Dead : 0

Abstract

A power failure caused severe disruption at the height of rush hour, stalling numerous overland and subway trains. The power failure also caused traffic chaos and led to the suspension of flights into the international airport.

The problem was eventually traced back to a power station where a construction crew interrupted a main electricity line.

Workers adjusted several 115-kilovolt lines turned power on without proper grounding (earthing), this caused a chain reaction, shutting down other power stations, pulling the plug on most of the city and its southern suburbs.

[electrical equipment failure, road transportation, rail transportation, air transportation, plant / property / equipment, operation inadequate, electrical, lack of earthing]

Lessons

[None Reported]

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

Location : Erith, UK

Injured : - **Dead :** 0

Abstract

A series of errors and an illegal pump connection at a foul pumping station resulted untreated sewage and dangerous chemicals contaminating a surface pumping station. Approximately 5 million gallons of effluent pumped from the station into a nearby river.

A further failure of the pumps at the water pumping station resulted in effluent, which could no longer be pumped into the river, filling the wet-wells that then overflowed into the street, at pressure, via the road gullies. The effluent reached and flooded nearby houses in which residents were evacuated for a considerable amount of time, some not able to return at all due to the toxicity of the chemicals.

The company was fined £250,000 and costs of £12,847 (2000).

[pump failure, human causes, drains & sewers, waste, environmental, evacuation, spill, toxic chemical]

Lessons

[None Reported]

Source : EUROPEAN CHEMICAL NEWS, 23-29 NOVEMBER, 1998.

Location : Augusta, Georgia, USA

Injured : 46+ **Dead** : 0

Abstract

Approximately 46 people were injured when a chemical release sent a toxic vapour cloud of sulphur dioxide and oleum into the atmosphere.

The incident occurred when an instrumentation failure caused chemical vapours to vent from a smokestack instead of collecting in a storage tank.

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

Lessons

[None Reported]

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

Location : Wales, UK

Injured : 0 **Dead :** 0

Abstract

Sewage spilled into a nearby river from a fracture sewer pipe. The area in which the spill occurred is an important spawning area for salmon, sea trout and brown trout.

The company took several days to rectify the problem causing further release of sewage.

The company was fined £3,000 and costs of £1,027 (2000).

[pollution, ecological damage, waste, drains & sewers]

Lessons

[None Reported]

1072815 October 1998

Source : BBC NEWS, OCT 19, 1998, (<http://www.bbc.co.uk>).

Location : , AFRICA

Injured : - Dead : 100+

Abstract

A fire and explosion occurred on a ruptured pipeline.

Local people were scooping up the leaking fuel from the pipeline when there was an explosion.

It is thought that ignition was caused by a spark from either a cigarette or a motorbike engine.

Many of the victims had become saturated by fuel.

[burns, fatality, fracture, transportation]

Lessons

[None Reported]

11383October 1998

Source : EUROPEAN CHEMICAL NEWS, 26 OCT, 1 NOV, 1998.

Location : , UK

Injured : 0 Dead : 0

Abstract

Approximately 80 tonnes of 36% hydrochloric acid leaked from a 200 tonne stock tank.

A pipe at the base of the failed, causing a gas cloud.

[storage tanks, pipeline failure, gas / vapour release, spill]

Lessons

[None Reported]

Source : BBC NEWS, 23 SEP, 1998,
(<http://www.bbc.co.uk>).

Location : , UK

Injured : 8 **Dead** : 0

Abstract

A road transportation incident. Eight people were treated at hospital in blood spill scare after more than 50 gallons of cows' blood leaked from a tanker onto a motorway.

Tests on the blood revealed no BSE contamination.

The remains of the tanker's cargo was transferred to another tanker and transported to an incinerator to be destroyed.

The cause of the incident is thought to have been valve failure.

[waste, road tanker]

Lessons

[None Reported]

Source : FIRE PREVENTION 331, APRIL 2000.

Location : Gilberdyke, Humberside, UK

Injured : 0 **Dead** : 0

Abstract

A fire occurred in a factory warehouse where waste rubber was processed and remoulded into tyres.

At the time of the incident a worker was welding a bracket in a metal container and had burned through the container's metal wall, which resulted in sparks and molten metal falling onto the floor. The sparks and molten metal ignited diesel residue under an adjacent tank. The building was destroyed in the fire.

Estimated loss is thought to be £810,000.

[fire - consequence, damage to equipment, metal - molten]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A fire occurred at a refinery when a crude splitter pump around line ruptured due to sulphidation corrosion. The rupture released hydrocarbons with a composition from naphtha to diesel. The pump around stream was released as a vapour with an ensuing fire jet ignited by autoignition. The fire caused subsequent ruptures in the main fractionator and other equipment.

No one was injured.

[fire - consequence, gas / vapour release, damage to equipment, refining]

Lessons

[None Reported]

11427 July 1998

Source : BBC NEWS, JULY 5, 1999,
(<http://www.bbc.co.uk>).

Location : , CHINA

Injured : 0 **Dead** : 0

Abstract

An incident occurred at a nuclear power plant leaving it crippled for more than twelve months.

The 300 megawatt plant was shut down last July after an apparent welding problem.

The problem caused bolts holding guide pipes to the main body of the reactor to fall off under strong water pressure, an official was quoted as saying.

[weld failure, high pressure, material of construction failure, operational activities, plant / property / equipment]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A plant used boron trifluoride (BF₃) catalyst, dissolved in ethanol. The catalyst was fed to the plant from a pair of drums which were pressurised to feed catalyst through one of two parallel filters to the reactor. The drain/vent system from the filters passed through a non-return valve to a caustic scrubber. One drum ran empty and the operator changed over to the second. He noticed high pressure drop over the on-line filter and changed this over too. A valve operating error exposed the non-return valve pressure, rather than the normal 1 bar, although this was still within its design pressure.

A leak then occurred from the cover of the non return valve. The BF₃ reacted with moisture in the air to form a dense cloud containing hydrogen fluoride which dispersed slowly due to calm weather conditions.

Operators donned gastight suits to enable plant isolation. A water curtain was used to contain the gas cloud and sodium carbonate to treat acidic material in the drain sump.

The non-return valve cover had been deformed due to overtightening of the bolts and the gasket thickness was too low for the duty, providing an inadequate seal.

[non-return valve, spill, gasket failure, processing]

Lessons

1. Better specification of equipment was required to ensure its fitness for purpose. This especially applies to pipework specification and materials, gasket materials and thickness. Checks required to ensure installed equipment meets specification.
 2. Need for a system to identify gasket thickness and type on the plant.
 3. Review need for automatic leak detection and benefit of remote isolation valves of the BF₃ banded area from the main effluent system.
 4. Assess danger of toxic fumes being drawn into the control room ventilation system.
-

1044806 June 1998

Source : CNN.COM, U.S. NEWS, 1998,
(<http://www.cnn.com>).

Location : , GERMANY

Injured : - Dead : 102

Abstract

A rail transportation incident. A high speed train crash killed 102 people. Evidence suggests that a wheel that might have broken from material fatigue could have caused the carriage directly behind the locomotive to derail. Parts of a broken wheel were found some six kilometres (four miles) ahead of the bridge. The train is believed to have derailed at a switch 300 metres (yards) before the bridge.

The locomotive uncoupled from the train, which then hurtled into a road bridge as the cars behind jack-knifed into one another. The road bridge collapsed on several cars, crushing the passengers inside.

[metal fatigue, wheel broken, derailment - consequence]

Lessons

[None Reported]

Source : FIRE PREVENTION 325, OCTOBER 1999.

Location : Wales, UK

Injured : 0 **Dead :** 0

Abstract

A fire occurred at a factory. It is thought that the fire was started accidentally by an undetected spark or molten material coming into contact with the exposed timber chipped composite board. This occurred when the contractors used abrasive cutting equipment to remove steel reinforcing bars from the concrete in their preparation work to fit a new hopper.

[fire - consequence, maintenance, hot work]

Lessons

[None Reported]

1261202 June 1998

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

Location : Somerset, UK

Injured : 0 Dead : 0

Abstract

Gas oil leaked from a large storage tank at a cellophane and film manufacturer and contaminated a wide area of land and underground water. An investigation found a small hole in the storage tank.

Approximately 160,000 litres (35,000 gallons) leaked into the ground around the tank compound. Checks revealed that the floor of the bund had not been properly converted from a previous use.

Decontamination of the site is thought to cost over £500,000 (2000).

The company was fined £30,000 and costs of £4,885 (2000).

[storage tanks, corrosion, design or procedure error, pollution, environmental]

Lessons

[None Reported]

1265005 May 1998

Source : ENGINEERS AUSTRALIA, JANUARY 2000.

Location : , AUSTRALIA

Injured : - **Dead :** 4

Abstract

A marine transportation incident. A fire occurred onboard a ship when diesel fuel leaked from a burst flexible hose onto a hot engine component in the main machinery space. Four people were killed in the incident.

[fire - consequence, hose failure, hot surface, fatality]

Lessons

[None Reported]

Source : FIRE PREVENTION 325, OCTOBER 1999.

Location : Wales, UK

Injured : 0 Dead : 0

Abstract

A fire occurred at a plastic factory. The fire brigade were called when a small fire was discovered in some scrap fibreglass.

Two workers attempted to extinguish the fire using carbon dioxide and a powder extinguisher. The premises were evacuated.

By the time the fire brigade had arrived, acetone and fibreglass resin stored on the premises were producing toxic gases, intensifying the fire and smoke.

Severe damage occurred to the building.

It is thought that a spark from welding equipment being used by workers had ignited a fibreglass drum.

[fire - consequence, evacuation, gas / vapour release]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 1 Dead : 1

Abstract

An explosion and flash fire occurred on the a drilling rig while drilling a well. The explosion on the drilling floor caused one injury and one fatality, both employees of the drilling contractor.

The investigation revealed that gas which broke out from the drilling mud collected in the enclosed space between the drill floor and the pollution pan used to prevent accidental discharge of oil based mud to sea. The gas was ignited by either stray currents or frictional sparks caused by metal parts from the floor covers and supports rubbing together.

It would appear that the basic cause of this incident was a failure in the design to recognise that by installing the collection pan, and thus creating a confined space, there was potential for gas to accumulate below the floor when the rotary motor was not operating providing ventilation for the enclosure.

There is no practical way to prevent gas breakout in the immediate vicinity of the pollution pan.

The rig is designed so that mud returns which do not immediately divert to the mud return line are captured here and drain to the return system.

[fire - consequence, fatality, design or procedure error, injury]

Lessons

The following recommendations from the report focus on preventing gas accumulation, and guarding against ignition possibilities:

1. Ensure that there is adequate ventilation below the drill floor to prevent gas accumulation during all operations.
 2. Install gas detectors with visual and audible alarms to monitor gas below the drill floor.
-

9059 18 January 1998

Source : CNN.COM, U.S. NEWS, 1998, (<http://www.cnn.com>).

Location : , RUSSIA

Injured : 24 Dead : 4

Abstract

A methane gas explosion occurred in a coal mine. The explosion occurred during the overnight shift, when 49 miners were inside the mine at a depth of nearly 3,000 feet.

The blast caused the shaft where the miners were working to collapse and set off a fire that raged throughout the day.

Methane, a naturally occurring colourless and odourless gas that seeps out of coal seams, can build up in poorly ventilated mine shafts and is easily ignited by a spark.

[fatality, mining, injury]

Lessons

[None Reported]

1040408 January 1998

Source : LOSS PREVENTION BULLETIN, 139, 22.; THE CHEMICAL ENGINEER, 15 JANUARY 1998.

Location : Glasgow, UK

Injured : 14 **Dead** : 0

Abstract

Fourteen workers were injured by hot metal and chemicals after a tank exploded. Two suffered fractured ribs while others were showered with shrapnel from the ruptured tank sustaining cuts and burns. The incident occurred when the workers were repairing the six-foot high tank. A hairline fracture was suspected to have caused the failure following the pressurisation of the vessel.

[explosion, tank failure, material of construction failure, unknown chemicals, injury]

Lessons

[None Reported]

124331998

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

An electrical fault occurred on oil filled switchgear in the main electricity intake substation of a chemicals plant. The fault resulted in a serious fire, which lasted for 2 hours and destroyed a section of a 3-section switchboard.

The incident eventually caused the loss of all electrical power to the site. The plant was shutdown.

Fortunately no one was injured.

The cause of the incident was due to an earth fault that occurred, probably in the cable box, downstream of a circuit breaker panel. This earth fault raised the voltage sufficiently to cause the failure of the centre-phase insulator between the busbar oil compartment and the circuit breaker oil compartment in panel 5 resulting in a second, more serious, busbar earth fault. This failure appears to be a random failure on a normally inaccessible component.

An investigation into the incident revealed that the key/key way clearances were too large and the torsional loads were carried by the dowel pin. The pin was overloaded and failed, and the half shaft blew out of the non return valve body.

The high energy of the arc (~7.7 MW), caused a severe over pressure in the circuit breaker oil tank which then burst and deposited the ignited oil in the cellar.

The fire in the cable cellar, melted the glands on other cables, letting the cable box grease fall into the cellar, also providing fuel for the fire. The fire also caused the incomer panel cable box, which has oil filled cables, to fail resulting in even more oil deposited into the fire spreading in the basement.

[electrical equipment failure, plant shutdown, fire - consequence, damage to equipment, lack of earthing]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A large oil spill (approximately 175 m³) occurred in a crude oil tank farm from two failed joints/gaskets. The failed joints/gaskets were at pipeline flanges on a 10 bar/150 psig section of the crude oil transfer line from the offshore production platform to crude tank at the refinery.

The flange joints/gaskets failed due to the transfer line being overpressured. The motorised inlet valve to the tank automatically closed following a spurious extra high tank level trip and this subjected the line to the maximum full discharge pressure of the offshore platform's main oil line pump. The line was not designed for the shut-in pressure.

The resultant spill of crude oil in the pipe trench was recovered using water and vacuum trucks.

The crude oil on the pig receiver slab was recovered in the oily/water sewer systems.

[joint failure, gasket failure, material transfer, refining]

Lessons

The report stated:

The implementation and continued integrity of process safety management systems must be assured through auditing and planned inspections

106051998

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

An on-line crude unit heat exchanger vent line was fractured during a lifting operation. The strap/webbing sling being used to install a tube bundle into the shell of the lower of a pair of horizontal heat exchangers came into contact with the vent line and fractured it releasing approximately 32 barrels of crude oil into the area. There were no injuries or fires.

The immediate cause of the spillage was a failure in the preparations to ensure that the crane operation could not damage equipment on the crude unit. The basic cause was a failure to provide a method statement and formal risk assessment for the crane lift and ensure that the vent line was adequately protected or decommissioned.

[design or procedure error, damage to equipment]

Lessons

[None Reported]

Source : LOSS CONTROL NEWSLETTER, 1997.

Location : , AUSTRALIA

Injured : 6 **Dead :** 2

Abstract

A fire occurred whilst work was being carried out on oil storage tanks. The fire is believed to have been started by a spark from a welder
[fire - consequence, welding, fatality]

Lessons

[None Reported]

Source : ICHEME

Location : , POLAND

Injured : 0 Dead : 0

Abstract

A small fire occurred on the joint/gasket of a heat transfer oil line.

The fire was extinguished, the damage was estimated at \$7,000 (1998). There were no injuries, product spillage or escalation of the fire.

It was later found that the joints/gaskets on the system were of the incorrect material for the hot oil duty.

Investigations into the cause of the incident confirmed that the fire started from a leaking joint/gasket on the ring side flange of a 20mm (three quarter inch) branch valve. This caused hot oil at 260 degrees C and 1.5 bar pressure to soak the insulation on the main heat transfer line.

Spontaneous ignition had most likely occurred as a result of oxidation of the heat transfer oil that had dispersed into the process insulating material.

[fire - consequence, heat transfer, damage to equipment, incorrect equipment installed, joint failure, gasket failure]

Lessons

It is not uncommon for oil soaked insulation to reach the auto-ignition temperature due to the oxidation and exothermic reaction. In this case, the auto-ignition temperature of the oil was 350 degrees C with a flash point of 208 degrees C.

Source : LOSS CONTROL NEWSLETTER, 1997.

Location : , CANADA

Injured : 0 Dead : 0

Abstract

A fire occurred when natural gas leaked from a 36 inch pipeline. Shutoff valves isolated the affected section and the gas fire burnt itself out. The fire also ignited a small secondary stubble fire in a nearby field. The cause of the line break is thought to have occurred due to corrosion.
[fire - consequence, transportation]

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 : , UK

Injured : 0 Dead : 0

Abstract

Between November 28, 1996, and January 5, 1997, power station steam boiler failures occurred.

Five high pressure (>100 bar) boilers in a power station steam boiler suffered tube failures. This was as a result of a water chemistry regime which had been operated for a considerable time with pH and chloride levels outside an acceptable operating range. Five tube failures occurred in 4 of the 5 boilers in the station over the period November 29, 1996 to December 14, 1996. The mode of failure varied between longitudinal splits and "window" failures where a section of the tube split and opened up like a door or window. In two of these cases there was evidence of localised thinning, but not in the other three. In all cases the failures resulted in the boilers depressurizing safely into the fire box.

The spate of rapid failures on separate boilers and metallurgical examination of the failed tubes pointed to a common problem causing internal corrosion of the tubes. The investigation, therefore, focused on the quality of the water provided to all of the boilers. A number of changes had taken place in the power station operations over the last 12 months. In particular a change from dosing the boiler feed water with ammonia to amine in June, 1996. Caustic having previously been used as a dosing chemical until ammonia completely replaced it. It was concluded that the mechanism driving the failures was hydrogen induced embrittlement caused by on-load acid attack, probably chloride based. It was also agreed that the onset of the acid attack could be measured in weeks/months rather than months/years. The localised thinning evident with two of the failures was attributed to "caustic gouging" which was postulated as "old" damage to when caustic soda was used as a boiler treatment chemical. Acid attack is generally associated with poor bulk boiler water chemistry, for example, high chloride and/or oxygen levels and low pH. It is known that boilers operating on an all volatile regime (in this case ammonia and more recently amine based) are particularly susceptible to this form of attack and that great care should be taken to maintain low levels of chloride. A boiler operating in a non-volatile alkali regime (e.g., caustic) can tolerate higher chloride levels because of the buffering effect of the alkali.

Following a study of the water chemistry history, it is concluded that the immediate cause of the boiler failures was acid chloride attack of the boiler tubes. The acid attack occurred as a result of the water chemistry regime which had been operated for some time with the pH being much lower than the control range.

There had also been a number of very low pH values during the period which would have resulted in the spate of rapid failures. The level of chlorides in the boiler feed water had also increased over the last 6 months as a result of the change to the blowdown from the boilers from continuous to "as required" between June and August, 1996, as a result of the perceived improvement in water quality. The speed of the failures was also enhanced by weak spots in the tubes as a result of caustic gouging which would have occurred when the boiler water was treated with caustic. The tubes were also prone to attack as a result of the protective magnetite layer being greater than 100 microns which would have cracked, allowing the water to penetrate to the metal surface.

Boiler operators were evidently aware of the low pH situation since mid November reports show, double and triple ammonia dosage required. Power station management were apparently unaware of these situations. No data was prepared in graphical form to show trends, although after the events this shows significant effects on blowdown and pH. Both the laboratory and the operators analysed the boiler feed water supply and drum quality. The operator tests were used to control the dosages, and laboratory testing had been recently reduced from daily to three times a week. A review of the results shows that the laboratory results are more accurate owing to superior calibrated equipment, and prompt testing in a professional manner. In fact, the level of knowledge of boiler water chemistry, the criticality of controlling pH and conductivity was not widely appreciated. On line measuring instruments were available in the control room but in various states of disrepair and not relied upon, and some alarm settings for conductivity were set beyond the allowable operating range.

The following repairs were made before recommissioning. The water chemistry for all boilers was changed to caustic injection, continuing the amine injection to increase pH to normal operating levels and to provide a more effective buffer against chlorides. The blowdown was returned to a continuous regime.

[refining, embrittlement, operation inadequate, plant / property / equipment]

Lessons

The following recommendations were made:

1. Institute improved process monitoring (e.g., Statistical Process Control) in all areas of the power station.
2. Establish water quality regime for the appropriate operating envelope for the long-term treatment chosen (caustic or all-volatile).
3. Provide relevant refresher training on water treatment, the impact of water chemistry on the performance of the boilers, and action to be taken if deviations are outside agreed control limits.
4. Investigate the demineralization plants operational performance in detail, preferably in conjunction with the manufacturer.
5. Control the boiler water chemistry in a more disciplined way within the agreed operating envelope.
6. Ensure that all existing on-line analytical control room instrumentation is working to their intended design.
7. Review and re-state roles and accountabilities of all staff in the power station, and check staff understanding and competency to carry out these roles.
8. Review and re-state accountabilities and relationships between the Power Station and the Laboratory for sample testing and subsequent use of test results for boiler water control.
9. Review the alarm and trip settings for on-line analytical instruments and provide guidelines to the operators for changing the stepwise cycle on the demineralization plant regeneration cycle.
10. Develop a structured program for improving the reliability of boiler plant.

Lessons Learned:

1. Plotting of water quality test results highlights trends in measured parameters.
2. Changes in operating regimes (blowdown and pH Control) require rigorous
3. Management of Change review.
4. By-passing routine (designed) operating procedures must signal that an operational review is required, and indicates that operators are taking unusual or desperate attempts to maintain the operation

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A process plant upset resulted in a smoky flare lasting 8 minutes. The smoke drifted across a local road, causing nuisance and potential hazards to drivers. Four external complaints were received, including one from the local police. The IPC limit was not exceeded by the incident. A seized non-return valve meant that the gas was vented to a different stack from normal, in addition, a steam control valve, which aids smokeless flaring had been removed in error, as it was assumed that the warm-up line would provide sufficient heating for smokeless venting.

[processing, gas / vapour release, valve failure]

Lessons

The lessons learnt covered the following areas:

1. Establishing ownership of the various sections of the system to ensure responsibility for maintenance, operation and modifications work.
 2. Review of the flare system design against best practice for smokeless flaring.
 3. Updating of operating and maintenance procedures for the flare system.
 4. Review of procedures to inform the Scottish EPA in the event of work which might effect smokeless flaring capabilities.
 5. A review of the radio system to ensure staff can be contacted effectively.
 6. Review of the plant operating procedures to minimise the potential for a similar process upset.
-

Source : TANKER CASUALTY REPORT NO. 22, TANKER CASUALTY DATA EXCHANGE SCHEME, INTERNATIONAL CHAMBER OF SHIPPING, LONDON.

Location : ,

Injured : 0 **Dead :** 1

Abstract

A fire and explosion occurred in the pump room of a tanker resulting in the death of one crew member.

A tanker was lying at anchor in a harbour after discharging a cargo of crude oil. Residual crude oil was being consolidated by pumping into one or two centre tanks. Leaks had earlier occurred into the pump room from defective lines, pump and valve glands and joints resulting in an oil and water mixture in the pump room bilges. A rag was used to plug one of the leaking seals in a bulk head. The atmosphere in the pump room was checked with an explosimeter but no gas was detected.

An officer and a cadet checked that the transfer was taking place satisfactorily. The officer left the cadet to go to breakfast. Some four minutes later an explosion occurred and smoke poured from the pump room and the two pump room ventilators, and a large amount of debris was blown onto the deck. The alarm was raised and a fire fighting party assembled but could not enter the pump room because of the smoke. The pumpman who was on the deck at the time of the explosion informed that the cadet had gone into the pump room earlier.

Because of concern over the possibility of further explosions and the unlikely possibility that the cadet had survived in the pump room, the pump room door was closed, the ventilators sealed and carbon dioxide released into the pump room to extinguish the fire.

The fire was extinguished some hours later and the pump room entered. The cadet was found dead on the upper pump room grating. The body showed evidence of extensive burning and the post mortem showed that he had died almost immediately.

Investigation showed that the source of ignition in the pump room came from the opposite side of the ship to where the main cargo pump and eductor were operating. Two pump room fans were operating at the time. It was noted that an inspection access plate on one of the fans was missing and it transpired had been missing for some time. The bearings on this fan had collapsed and markings on the fan showed that fan blades had been touching at some time. It was concluded the cause of the explosion was a spark created by the fan blades touching, combined with an explosive air mixture resulting from the oil and water accumulation in the pump room.

The reason why the cadet entered the pump room without the authorisation of a responsible officer was not known, but it was concluded that his action had nothing to do with the explosion.

[fire - consequence, marine transport, unloading, fatality]

Lessons

The incident showed the importance of maintaining bilges dry at all times in order to prevent any possibility of an explosive mixture forming where machinery is operating.

1. Ventilation in pump rooms should be designed to prevent the formation of stagnant air pockets, especially low down. This was shown by the fact that the accident occurred despite consistent explosimeter readings of 5% being recorded over the previous two days. As a result of the accident, the company modified its ships to ensure that ventilation suction points were below the pump room floor lower grating. Also, all ships with steam fans were modified by removing the fans to outside the pump room and fitting them in the main ventilator trunkings.

2. Regulations regarding unauthorised entry to certain sections should be enforced more strongly.

Source : LOSS CONTROL NEWSLETTER, 1997.

Location : , USA

Injured : 0 Dead : 0

Abstract

A crack occurred in a flange on an undersea pipeline, which led to a spillage of 30 tonnes of crude oil. The line was shutdown when the leak was detected. The spillage was contained.

[environmental, transportation]

Lessons

[None Reported]

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

Location : , TAIWAN

Injured : 0 Dead : 0

Abstract

An explosion occurred on a gas pipeline which was accidentally ruptured by workers. The leaking gas ignited by sparks from passing motorcycles.
[human causes, transportation]

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]

8927 24 July 1997

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

Location : Texas, USA

Injured : 0 Dead : 0

Abstract

Oil leaked from a marine tanker during lightering, apparently due to hull crack suffered in collision a month earlier but no damage was found at the time.

Lessons

[None Reported]

1060016 July 1997

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Fuel oil spill from failed pipe. A routine transfer of heavy fuel oil was initiated. This was to move product from one tank to the utilities bunker tank. The pumping rate was approximately 1500 bbls/hr and the system was checked prior to shift change by the area operator.

During routine surveillance (after shift change) the area operator noticed a quantity of product within the drainage ditches inside the bunded area. Further investigations identified a leak from pipework underneath a road crossing. The transfer was immediately stopped and the system isolated.

Using tank dips it was estimated the spill was approximately 1000 bbls.

The area is bunded and penstocks have been fitted to protect the refinery surface water system from contamination should an incident like this occur. The vulnerability, particularly with

the age of some of the pipework, had already been recognised. The protection system worked well and the spill was contained within the drainage system inside the bund. There was no

product escape into any other area. Initially, a bowser was organised to recover product. This was replaced by a steam driven pump to speed up the operation. All oil was recovered back into the fuel oil component tankage.

It has been concluded that the pipework failure occurred due to external corrosion and that initial construction specification offered inadequate protection for the local environment.

[material transfer, design or procedure error]

Lessons

[None Reported]

1198207 July 1997

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A small fire occurred on a plant after a solvent (ethyl acetate) leak from a pump, the plant was shutdown. Subsequently a storage tank overflowed approximately 10 tonnes.

[fire - consequence, plant shutdown, storage tanks, spill, pump failure]

Lessons

[None Reported]

8900 02 July 1997

Source : HAZARDOUS CARGO BULLETIN, 1997, AUG,; LOSS PREVENTION BULLETIN, 136, 24.

Location : Valencia, SPAIN

Injured : 0 **Dead** : 18

Abstract

A marine transportation incident. A fire occurred onboard a tanker whilst under construction in a shipyard. A welding spark allegedly ignited diesel fuel being pumped aboard.

[fire - consequence, fatality]

Lessons

[None Reported]

Source : CHEMICAL HAZARDS IN INDUSTRY, 1997, NOV.

Location : , CANADA

Injured : 50 **Dead :** 0

Abstract

A release of chlorine gas occurred on a unit at a vinyl plant causing evacuation of the area. An instrumentation failure caused vent lines to build excess pressure which backed chlorine into an air line and released a mixture of chlorine and air for about five minutes. The chlorine gas drifted south of the vinyl unit towards an adjacent polyethylene plant, which was evacuated. 50 people were treated for eye and throat irritation.

[vapour release]

Lessons

[None Reported]

Source : CHEMICAL HAZARDS IN INDUSTRY, 1997, NOV.

Location : , USA

Injured : 0 Dead : 0

Abstract

A fire and explosion occurred disabling an olefins plant, the cause was a suspected air assisted check valve failure.

[fire - consequence]

Lessons

[None Reported]

8910 22 June 1997

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

Location : , IRAN

Injured : 31 Dead : 8

Abstract

An explosion occurred in a colliery killing eight and injuring 31 and trapped 150 miners underground, allegedly due to electrical short circuit igniting methane gas.
[fatality, injury, mining]

Lessons

[None Reported]

Source : LOSS CONTROL NEWSLETTER, 1997,; ENDS REPORT 269, JUN, 1997,; ECN, 16-22 JUN, 1997.

Location : , UK

Injured : 0 Dead : 0

Abstract

About 5 tonnes titanium tetrachloride leaked into cooling water system in a heat exchanger, corroding a pipe and was released into the atmosphere. A dense white cloud of hydrochloric acid and titanium oxychloride occurred. Prohibition notice issued.

[cooling equipment, gas / vapour release, corrosion]

Lessons

[None Reported]

Source : ICHEME

Location : , USA

Injured : 0 Dead : 0

Abstract

At 04:45 hrs., a tube leak was discovered in a naphtha treater furnace. The furnace was built in 1958 with one and a quarter percent chrome aluminised tubes. Most of the tubes were replaced with 5% chrome in the late 1950s and early 1960s because of tube failures due to overheating. The tube that failed was a 1960 replacement tube. The designed firing rate was 47.9 MM BTU/Hr. Presently, it runs at 71.5 MM BTU/Hr. This change in operating conditions went through the "management of change" procedure in February, 1997. Although the furnace would not have met the companies recommendations for burner to tube spacing in a new installation, it was determined to be an acceptable safe operation if tube skin temperatures were monitored and kept under 925 degrees F (496.1 degrees C).

Over the past year, the refinery had started the implementation of a furnace management program on this particular furnace. Some of the items addressed were burner maintenance and adjustment, additional instrumentation and calibration with operator training. Improvement was noted in its operation since then, but the furnace tube failed anyway.

Prior to the incident, the operation of the furnace and process unit were normal. The furnace tube leak occurred in a bottom row tube of the south coil. Smoke was detected coming from the convection heater stack at 04:45 hrs. by two supervisors as they were exiting the control room's south door. The furnace tube leak was verified by a supervisor who, was able to see the smoke coming out of the naphtha treater furnace stack and the flames in the fire box. He warned others to stay away from the furnace. Several operations personnel went on to the eastside deck to verify the leak, but because of the flames in the box they were not able to see where the leak was. They went to the westside deck and were able to view inside the box, then left the furnace area. Less than a minute after their departure, at about 04:58 hrs., according to the process alarm, the tube massively failed and engulfed the furnace structure in flames. For the operations personnel who had been on the furnace deck, this was truly a "near miss" event.

The fire alarm was sounded, security was called to page the emergency response team, and the fire department was summoned. A decision was also made to shut down the other units. The furnace was quickly isolated (about 05:15 hrs.) and the fire was contained to the furnace area and under control within 20-30 minutes.

Total loss was about \$3 million (£1.7 million) (1997). Business interruption accounted for \$2.2 million (£1.2 million) (1997) and property damage \$0.8 million (£0.6 million) (1997). The naphtha treater furnace was recommissioned on May 24, 13 days later.

An investigation found that the failed tube, which was a 5 Cr tube, was coked locally in between two burners closest to the east end of the furnace (south pass). A tight adherent layer of coke, about a quarter inch in thickness, was inside the tube located on the fire side of the tube. This layer of coke could be expected to raise the temperature of the tube close to 300 degrees F. This led to longer term overheating and eventual longitudinal bulging. A crack occurred causing the initial release of naphtha into the firebox. This was followed a few minutes later by the tube being ripped open circumferentially releasing 600 psig naphtha into the furnace. This type of failure is not typical, but is more likely to occur in high pressure services.

[heating, furnace, tube, furnace tube, overheating, tube failure, fire - consequence, rupture]

Lessons

The following recommendations were made:

Continued flame impingement on tubes in any hydrocarbon furnace will lead to localised coking and eventual tube failure. Management of change procedures must be applied when changes to materials are proposed, or when duty beyond original design is required.

Tube leaks in furnaces operating at high pressure are likely to have a sudden and catastrophic failure. Attempting to make further visual inspections is a significant risk.

Emergency response plans should be regularly tested, and include the communications and "call out" systems.

Process operators must be trained in the actions to be taken following a tube rupture.

Source : LOSS CONTROL NEWSLETTER, 1997,; CHEMICAL HAZARDS IN INDUSTRY, OCTOBER 1997.

Location : , USA

Injured : 0 Dead : 0

Abstract

A fire resulted from the failure of a large pump. 50% of production was lost as a result of the incident. The company makes hexamethylene diamine for the production of nylon. The fire dramatically affected nylon fibre supplies for a couple of months. The cause of the pump failure is thought to have been due to metal fatigue.

[fire - consequence, pump failure, product loss, operational activities]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 **Dead :** 0

Abstract

Approximately 210 kgs of dope (composition approximately 27% acetate and 73% acetone) was spilt when a joint line failed. The spilt dope was recovered and put into a mixer for reuse.

[joint failure, spill]

Lessons

[None Reported]

11665May 1997

Source : TANKER CASUALTY REPORT NO. 21, TANKER CASUALTY DATA EXCHANGE SCHEME, INTERNATIONAL CHAMBER OF SHIPPING, LONDON.

Location : ,

Injured : 0 Dead : 0

Abstract

A marine transportation incident. An explosion occurred on a ship at sea whilst it was transferring dirty ballast. No one was injured. The ship was proceeding in ballast after having discharged a cargo of crude oil. Four holds contained dirty ballast, two holds clean ballast and the remaining empty holds had been cleaned. Dirty ballast was being discharged from a hold which was three-quarters full when an explosion occurred which blew the open hatch covers overboard and caused slight damage to the hatch conning. There was a force 6 wind blowing with rough seas and the ship rolling at the time of explosion (0702 hours).

No definite cause for the explosion was apparent. The possibility of a spark generated by steel to steel friction was discounted. It was concluded that a charged mist and charged water slugs may have formed which on discharge could have caused a spark.

The accepted approach regarding gas concentrations in tanks was that an overrich atmosphere was safe because it was not within the flammable range. Overrich atmospheres are, however, difficult to maintain with any reliability in tanks. Accurate gas measurements now indicate that this assumption may be erroneous and consequently the atmosphere in the tank at the time of the explosion was probably within the flammable range and therefore adequate to propagate an explosion.

[material transfer]

Lessons

1. The operational procedures for the discharge of ballast and tank cleaning were changed following the accident. The assumption that an overrich atmosphere is safe is not now accepted and tanks are now kept gas free during operations. This is achieved by ventilating with fans throughout the discharging and cleaning operations. Measurements are taken at regular intervals to ensure that the atmosphere is below the lower explosive limit.
 2. Following the accident, a recommendation was issued by the International Chamber of Shipping to the effect that OBO type ships should be operated in such a manner as to avoid slack tanks, thus obviating the possibility of ignition by compression or by static electricity.
-

Source : CHEMICAL HAZARDS IN INDUSTRY, 1997, OCT.

Location : Texas, USA

Injured : 0 **Dead** : 0

Abstract

A fire occurred due to metal fatigue in a pump on a amethylenediamine unit. No injuries were reported.

[fire - consequence]

Lessons

[None Reported]

8817 May 1997

Source : CHEMICAL HAZARDS IN INDUSTRY, 1997, NOV.

Location : , USA

Injured : 0 Dead : 0

Abstract

An oil pipeline ruptured spilling 5000 bbl of crude oil into a lake. About 2500 bbl was moped up with absorbents. Inspection revealed a 34 inch gash in the damaged segment of pipe.
[crack]

Lessons

[Noen Reported]

Source : CHEMICAL HAZARDS IN INDUSTRY, 1997, JUL.

Location : Renfrewshire, UK

Injured : 1 **Dead** : 2

Abstract

An explosion and fire occurred killing two workers and seriously injured a third. Investigation suggests that a metal part of a test-probe, which was being inserted into a ring main unit, possibly to check for a fault on an 11kV cable, became detached and fell into live busbars at the bottom of the oil tank within the unit. This could have caused an internal short circuit leading to the explosion and fire.

[fire - consequence, fatality, injury]

Lessons

Users of oil filled ring main units are advised to ensure that the test probes are verified and maintained at all times.

Source : ICHEME

Location : , SOUTH KOREA

Injured : 0 **Dead :** 0

Abstract

An explosion occurred when construction workers dug up a pipeline. Flames shot 50 ft into the air. Telephone lines and part of a subway under construction were destroyed as a result. A crane is believed to have sparked the blast when it hit a gas pipe left standing in the centre of the work site. 500 firefighters were involved in the incident.

[drilling/digging/ploughing vehicles, natural gas, leak, fire - consequence]

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]

3204 18 March 1997

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

An incident at a coatings plant. A let-down tank containing a white spirit based resin, overflowed by approximately 800 litres. The site was evacuated and the spillage cleared.

The level in the tank was controlled by a PLC. The PLC had correctly opened the inlet valve to the tank, but the incident happened when the valve failed to shut. It was discovered that the controller on the valve had drifted out of calibration.

[evacuation, valve failure]

Lessons

Data store to check and calibrate controllers.

Install additional valves to this, and other tank inlets and hard wire from high level switches.

3291 26 February 1997

Source : LLOYDS LIST, 27 FEB, 1997,; ECN 3-9 MARCH 1997

Location : , GERMANY

Injured : 0 **Dead :** 0

Abstract

A fire broke out during the demolition of an empty storage tower/building. The fire, caused by blow torch sparks, was brought under control within an hour.
[fire - consequence, storage equipment, hot work]

Lessons

[None Reported]

Source : LOSS CONTROL NEWSLETTER, 1997.

Location : , USA

Injured : 0 Dead : 0

Abstract

A break in a 26 inch natural gas pipeline sent a huge fire ball visible 30 miles away. There was also an apparently unrelated break in the pipe 220 miles away. The ruptures were caused by stress on the pipeline created by land movement.
[fire - consequence, earth movement, transportation]

Lessons

[None Reported]

9028 09 February 1997

Source : CHEMICAL HAZARDS IN INDUSTRY, 1997, AUG.

Location : Texas, USA

Injured : 0 Dead : 0

Abstract

Three hundred and thirty pounds of liquid, mostly water but containing 1.5% acetic acid was released. The spill occurred when a control valve failed on a solvent stripper.

No injuries were reported and contamination was minimal.

[mechanical equipment failure, valve failure]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

The failure of a tank discharge pump caused a tank containing acetic acid and anhydride, to overflow into its bund. The standby pump was started. However a leaking flange required the level in the bund to be controlled by pumping out into road tankers, and to discharge approx 40 to 50 tonnes to trade effluent. This was contained at the water works, with no resultant spillage to the local river.

[pump failure, near miss]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

Passing diesel fuel oil valves on a burner allowed fuel to vaporise in a boiler, which had been shut down by interlock due to either low water level or low fuel pressure. The fuel reached the autoignition temperature in the economiser section and exploded twice. The first, smaller, explosion consumed the oxygen in the shutdown boiler, the main explosion occurred when mixed with air during the start-up purge cycle. The nitrile seats of the valves were affected by an additive in the fuel while those with fuel oil seats remained with tight shut off.

Three boilers were firing diesel fuel owing to a gas supply restriction. During the morning rounds the fuel supply was changed to tanks 2 and 3 from tanks 4 and 5 in readiness for the 11:00 am delivery to tanks 4 and 5. At approximately 2:30 pm, boilers 1 and 3 went to the lock-out position; and there was a dull thud in Boiler 3 with a smoky atmosphere and a smell of fuel oil. It was noticed that the fuel oil supply pressure was lower than usual and so the supply tanks were changed to feed from the refilled tanks 4 and 5. The Boilerhouse Supervisor decided to restart the lead boiler, Boiler 3, and switched off Boiler 1. The purge cycle for start-up of Boiler 3 was commenced and at 2:45 pm the explosion occurred within Boiler 3. The fire detection system was activated which automatically called the Fire Brigade. The operator isolated the fuel oil pumps and tanks from Boiler 3 before leaving the Boilerhouse, a major incident forward control team attended the site, along with the external emergency services.

An investigation concluded that fuel gas was not the source of the Boiler 3 incident. Isolation procedures used by the Boilerhouse Operator had been correct, and all valve interlocks on the gas isolation system had functioned correctly. Pressure tests carried out on the shutoff valves showed that one was passing. While reports of fluctuating oil pressure leading to boiler lock out could have been caused by air in the fuel, the tank levels were never low enough to allow ingress of air. After the boiler was depressured, a fuel oil deposit was found in the boilers. Analysers showed this to be the heavy ends of diesel fuel oil. After dismantling the fuel oil shut-off valves, it was found that the rubber "O" ring seals and associated diaphragms had been attacked by the fuel oil, causing swelling which had prevented the spring return from shutting the valve properly. The seal material was found to be "Nitrile" which was originally specified by, the valve manufacturer, to be suitable; but, due to later inclusion of certain additives within the fuel oil, was now the preferred material. Investigation of the boiler showed that the economiser and flue gas ducting took the brunt of the damage rather than the boiler itself and indicated that the explosion occurred in the flue gas outlet.

The following corrective actions were taken:

1. Replace all fuel oil "Nitrile" valve seals and diaphragms with fuel oil on boilers 1 and 3.
2. Update maintenance schedules to inspect fuel oil shut-off valves every two years for signs of seal distortion.
3. Ensure that all plant and equipment in fuel oil service has been installed to the correct material specification.
4. When firing fuel oil, should a burner lock-out occur, the fuel oil supply line should be manually isolated and the boiler left idle for at least 20 minutes before the air purge is commissioned.
5. Produce an operations manual for all plant in, and associated with, the boilerhouse.
6. Ensure that any future modifications carried out to the boilers are covered by the "management of change" procedures at the site.
7. Produce up to date and accurate drawings of all boilers and the associated instrument and control systems. Field checking will be an integral part of this exercise.
8. Review the boiler level control system, identifying improvements which will lead to greater operational stability and therefore fewer trips during normal operation.

[low pressure, process causes, explosion, seal failure]

Lessons

A robust management of change procedure is essential to address subtle changes to equipment or changes to process materials, in this case additives to the fuel oil.

The integrity of the fuel isolation systems for boilers and heaters should be regularly inspected and reviewed.

Source : ICHEME

Location : , FRANCE

Injured : 2 Dead : 0

Abstract

A fire broke out at gas oil hydrodesulfurization unit. The fire was caused by a leak of gas oil and gaseous products from the flange of a temperature control valve. The fire, restricted to the reactor section, was put out within 35 minutes by the refinery fire brigade. Two operators were injured while manoeuvring an extinguisher, but did not incur a lost time accident. The incident occurred following gasoil feed upset in the late morning, heavy rain in the afternoon and a hailstorm at about 22:30 hrs. The fire resulted in damage to control valves, piping, cables and associated heat exchangers.

[flange, valve, refining, rain, design inadequate, inspection inadequate, fire - consequence, flange failure, injury]

Lessons

Wafer type valves which, by design, are installed by "insertion" are unreliable and liable to leak.

All wafer valves to be identified and a risk assessment carried out to review their continued suitability in service.

Critical flanges need to be identified and regularly inspected, following an established procedure.

The investigation team concluded that the incident was caused by the following factors:

1. Inherent design weakness of the wafer type valves.
 2. The poor condition of the flanges on the valves and piping.
 3. Thermal shock imposed on the valves due to severe weather conditions (rain and hailstorm) and process upset earlier on in the day.
-

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A flash fire occurred as a driver was preparing to load his truck. Evidence suggests that a static spark ignited residual gasoline vapours in the truck's vapour return pipe and vapour recovery hose as the latter was in the process of being connected up to the truck. The fire was extinguished by closing the cover of the truck's vapour recovery pipe and by a second driver using a hand-held fire extinguisher. There were no injuries to employees and no damage to the loading rack equipment.

The driver had pulled under the loading rack, set the truck's brake and connected the earthing/grounding wire. The weather was clear and dry (temp 80 degrees F) (27 degrees C) (humidity 27-32%). The driver was wearing the correct personal protective equipment.

The system had shown a green light indicating it was safe to start to attach the vapour return hose. The system was subsequently tested and found to be in good working order on both the loading rack and on the truck. The system is "self-checking" and the green light denotes satisfactory earthing and grounding which permits the truck to load product. However, the system does not indicate that the product loading hose and the vapour recovery hose are electrically continuous and grounded/earthed. The loading rack electrical structure ground/earth was tested and found to have less than 1.0 ohm resistance to true ground/earth. The overhead vapour recovery system piping was electrically bonded to the loading rack structure and no stray currents were found. The vapour recovery collection pipe on the truck's tank was properly attached and electrically bonded to the trailer. However the vapour return/recovery hose did not have an embedded static wire and was not electrically bonded to the loading rack structure. Continuity testing of the loading rack's product loading and vapour return/recovery hoses was not included in the facility's preventative maintenance plan. It could not be determined how the static charge accumulated in the vapour recovery hose.

The second driver also found that the operating handle on the truck mounted fire extinguisher used to extinguish the flares was difficult to depress due to an accumulation of road grime.

[fire - consequence, loading, road transport, lack of earthing, electrical]

Lessons

All parts of the road truck loading system must form a continuous electrically conductive path including the vapour return/recovery piping/hose arrangement.

111451997

Source : ICHEME

Location : ,

Injured : 1 Dead : 0

Abstract

A chief engineer was carrying out regular planned maintenance on the emergency back-up ballast override system. The valve in question is designed to "fail safe open". However, in an emergency, this system will close the valve via the regulator, using a nitrogen bottle at 2500 psi. The maintenance procedure called for the regulator to be function checked using the rig air supply. The nitrogen bottle is then weighed to confirm that the correct volume is in place. On this occasion, the chief engineer decided to take one further step and open the nitrogen supply to the regulator, as this is what would take place in practice. When he did, the regulator blew apart and struck his hand, fracturing it. He needed to be hospitalised.

Investigation revealed that the regulator was only rated to 500 psi. The correct one had been orderd for the installation in 1994, however, a 500 psi regulator was supplied and installed, with the error unnoticed until the incident.

[pressure meter/control, incorrect equipment installed, people]

Lessons

The following recommendations were made:

Site managers should ensure checks are performed on similar safety-related devices to ensure that the correctly rated regulators are in place.

Mechanical supervisors/team leader should ensure that adequate checks are made on the rating of pressure regulators when they are supplied to the site or installation.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

During routine inspection it was noted that rust stains were showing on paint work on the boot of an low pressure separator, at an interface with insulated and non-insulated areas. On removal of the insulation, an area of corrosion 50 mm X 25 mm X 8 mm deep was revealed. The corrosion was caused by the stainless steel cladding making contact with, and cutting through, the protective coating and into the carbon steel vessel. Water ingress and galvanic corrosion then exacerbated the problem.

[pressure raising/reducing equipment, damage to equipment]

Lessons

The following recommendations were made:

Engineers are reminded of the risks of corrosion from galvanic action where dissimilar metals may come into contact.

Rust staining should be investigated.

112021997

Source : ICHEME

Location : ,

Injured : 2 Dead : 0

Abstract

An electrician was using a metallic mirror to inspect the back side of a breaker connection in a 480 volt motor control centre when a metal part of the mirror came into contact with an energised portion of the breaker, causing a large electrical arc.

Two employees received second degree burns from the flash over. Two of the three alkylation units on the plant shut down from the power surge and Crude/Vac suffered reduced feed rates for a short period.

The immediate cause of this incident was the use of metallic tools to inspect hot electrical equipment.

[inspection, circuit breaker, arcing, operator error, injury]

Lessons

Use only non-conductive tools and proper safe work practices when required to work on live (hot) electrical equipment.

112031997

Source : ICHEME

Location : ,

Injured : 1 Dead : 0

Abstract

An old power transformer needed to be replaced with a new more powerful one. Electricians isolated the old one to remove it from its location. They put the circuit breakers into the off position on the 6600 volt inlet to the transformer and the ones on the 415 volts outlet which supplies the wharf facilities. They then started the emergency diesel generator to supply power to the users. Since the outlet of this emergency generator is connected to the outlet of the transformer, these power cables were alive (energized). When an electrician separated the connecting cables from the transformer body, a short circuit happened and an electric spark occurred.

One electrician was exposed to spark light and his eyes were irritated. He was hospitalised for a few hours.

[modification, transformer, circuit breaker, competency lacking, short circuit, testing inadequate, injury]

Lessons

When working on electrical systems and equipment even it is electrically isolated from surrounding, all connections must be measured with proper instruments.

112041997

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A tube failure on the fin fan air cooler released, over a period of 1 hour, approximately 2 tonnes of butane and 10Kg of HF (hydrogen fluoride) vapour.
[processing, condenser, fin fan cooler, gas / vapour release]

Lessons

Current monitoring of the condenser tube X radiographs, at 2 yearly intervals did not identify the fault. The monitoring program is being reviewed.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Excessive damage was caused to a gas compressor seal by the outer seal leak pressure detectors failing to detect a sudden rise in seal gas (nitrogen) pressure, the result of a partial failure of the seal. The compressor continued to run with a damaged seal for a further 27 minutes before finally tripping on high vibration. The high pressure compressor seals subsequently required changing.

The seal gas pressure detectors are "smart" transmitters ranged 0-800 mbarg with an alarm at 300 mbarg and a trip at 600 mbarg connected into a PLC for machine control. If pressure is applied to a "smart" transmitter in excess of its calibrated range it will create a "transmitter failure" alarm for the duration of the over-range condition. Once a transmitter failure alarm is initiated, no further alarms can be created. Trials were carried out and a pressure of 1 barg of air was applied to the "smart" transmitters in a short period of time. The transmitter went into over-range condition and failed to register any alarm or trip condition. Once a transmitter failure occurs, the trip function is inoperative.

[instrumentation failure, seal failure, damage to equipment, processing, process control & instrumentation]

Lessons

The following recommendations were made:

Control engineers to review the use of "smart" transmitters on applications with alarm or trip functions.

Consideration to be given to modifying the control circuit on all "smart" transmitters which have a trip function to ensure that, in the event of transmitter failure, a trip will be initiated.

An alternative consideration may be to slow down the speed of response from the normal 300 msecs to a maximum of 16 seconds using the hand configurator to allow the high pressure alarm to be initiated before any transmitter failure alarm is created by overpressure.

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

During a monthly reconciliation inspection of a gasoline tank, it was discovered that the water bottom had virtually disappeared. When the inspector and tank farm operator returned on the following morning to check the dip, an oil leak from beneath the tank floor was visually evident. Investigations later revealed there had apparently been a low level leak from the tank since it was last filled in October 1996, and the leak increased significantly on December 31. Approximately 125 tonnes of product had leaked out. A major incident was declared at the site at 10.30 hrs., and gasoline was transferred out of the tank and water injected to re-establish the water bottom. Recovery of gasoline from the spill in the bund (dike) commenced that evening.

The tank farm consisted of six motor spirit storage tanks. The tank levels are monitored by a monitoring system at the central control room. Tank level information is then transferred to the refinery operating system and at every midnight into the information system. Within the monitoring system, a "deadband" of 12 mm was set within which the tank is defined as "inactive" - i.e., not moving. This means that an alarm is initiated if the tank level indication falls or rises by 12 mm. If the deadband is reset after an alarm, the original set-point is lost. There was no record of alarms and therefore no "trending" of a possible longer term leak.

All the motor spirit tanks had been inspected within the relevant code inspection period and had their repair recommendations carried out. There had been two previous floor failures, one of which involved the same tank in December 1985. No under floor corrosion was evident and following repair, the tank floor was vacuum box tested and fluorescent tested before returning to service.

A change in temperature of less than one degree is sufficient to change volume to activate the deadband alarm. The deadband alarm associated with these tanks has been seen as a "nuisance alarm" by the various shifts, and past inspections in reactions to alarms showed no evidence of leakage.

Loss reconciliation shows a loss of 573 tonnes with the possibility that part of a further 400 tonnes in pipe work probably contains some water.

[tank failure, rupture, storage]

Lessons

The following recommendations were made:

1. Open up the tank for cleaning for inspection as quickly as practicable to determine the nature and cause of failure.
 2. Review dead band alarming and the potential for nuisance alarms and discuss problem with operating teams.
 3. Make immediate efforts to empty two of the remaining "in service" tanks, one for inspection and one to be available for receipt in the unlikely event a problem arises with another tank.
 4. Repeat a loss reconciliation following the next tank movement to ensure all pipe work contains motor spirit, so that a full and final reconciliation can be made.
 5. Complete recovery operation and quantify the amount of gasoline recovered.
 6. It is important that the long term level trend of infrequently moved tanks be monitored to detect any low level leak.
- Frequent "nuisance" alarms must be thoroughly investigated; otherwise, they will be ignored in a real alert.

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A pump failure on the plant, due to burn out of associated switchgear, occurred on a train of four in parallel recycle diluent pumps, leading to plant shutdown. There had been tripping out problems experienced for several days before the burn out of the switchgear which had necessitated maintenance. The pumps had been uprated about 10 years previously from their original duty specification, but the switchgear had been considered adequate for the new duty, and was not uprated. Further minor uprating of pump performance took place during the most recent plant shut down earlier in 1996. There had been no operating problems until those experienced in the few days preceding the incident. The immediate cause of the incident was, on investigation, found to be starter isolator failure. Incorrect assembly at the time of manufacture had been exacerbated by the effects of uprated duty and by recent maintenance modifications.

[mechanical equipment failure]

Lessons

[None Reported]

1197104 December 1996

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

930 kgs of flammable liquid, a mixture of acetic acid, ethyl acetate, benzene and water was released when a pipeline flange joint failed, during a plant start-up. This mixture was released to dirt drains.

[joint failure, spill]

Lessons

[None Reported]

9020 December 1996

Source : CHEMICAL HAZARDS IN INDUSTRY, 1997, SEP.

Location :

Injured : 2 Dead : 0

Abstract

An explosion occurred when sparks from a cutting torch ignited vapours emitted from a barrel of scrap metal injuring two workers.

[hot work, vapour cloud explosion, gas / vapour release, flammable chemical, injury]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

During the start-up of an anhydride unit a flange leak occurred resulting in the loss of approximately 5 tonnes of a mixture of acetic acid, acetic anhydride and smaller quantities of benzene. The leak spilt into a dirty drain and was contained on site by being diverted to a containment pit. An incident response team was on standby throughout.

[flange failure, spill, near miss]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 1 **Dead :** 0

Abstract

An operator was setting up a test rig to carry out pressure valve checks. A pressure reduction valve failed and a piece of the valve hit his hand.
[valve failure, people, testing]

Lessons

[None Reported]

Source : OIL AND GAS JOURNAL, 1996, NOV, 25.

Location : , MEXICO

Injured : 4 Dead : 19

Abstract

An explosion occurred in a gasoline storage tank attributed to faulty valve. About 100,000 bbl of leaded and unleaded gasoline burnt out of control for more than 36 hours, destroying 2 of 6 storage tanks. More than 5,000 people were evacuated from adjacent residential area. Fatality.
[fire - consequence, evacuation, valve failure]

Lessons

[None Reported]

Source : ICHEME

Location : , FRANCE

Injured : 0 Dead : 0

Abstract

An off-site crude unit charge pump operating in parallel with another, caught fire from the mechanical seal about one and a half hours after a common alarm had sounded. The initially small fire spread to the adjacent pumps and the crude unit was shut down for 24 hours until one of the pump's electrical wiring and instrumentation could be repaired. The cause of the vibration leading to the seal failure is either motor bearing failure or coupling failure due to loss of alignment, and there was evidence of cavitation an hour before the initial vibration alarm.

On this refinery the Crude Distillation Unit control room is fed from three identical crude oil feed pumps (A), (B), (S) located off-site in the crude tank farm area about 1 km from the unit. In normal operations two pumps are running in parallel with one spare. Each pump is fitted with a common alarm for six bearing temperatures (two on the electric motor, four on the pump itself) and a vibration detector. At the time of the incident (A) and (S) were running. Analysis of flow recordings and tank levels shows a reducing flow rate as tank level (1) fell. This was a usual event and the new tank (2) was placed in service at 05:50 hrs., about an hour before the first common alarm. Vibration analyser charts show evidence of cavitation in (S) at 05:50 hrs. and this disappeared after the tank change. The common alarm sounded in the control room at 06:48 hrs. Because no vehicle was available and because the alarms were considered unreliable, it was left to the day operator to check the alarm on his rounds, about one and a half hours later. By this time the pump operation had deteriorated seriously, crude was leaking and the fire developed. It was promptly extinguished by the fire crew but the crude unit was shut down until the electrical wiring for one of the other pumps was restored allowing start-up.

Two potential immediate causes have been identified. These are:

1. Rupture of the coupling membranes.
 2. Failure of the bearing on the coupling side of the motor due to lack of oil or mechanical misalignment.
- [fire - consequence, mechanical equipment failure, excessive vibration, design or procedure error, fire - consequence, refining, pump bearing, plant shutdown, lubrication failure]

Lessons

The following recommendations were made:

1. Operators must respond to alarms, no matter if they may be nuisance alarms.
2. Equipment does have a limited performance capacity, and operating at extremes places operations at risk.
3. Monitoring devices must be maintained in proper working order, especially those for remote operating areas where operator surveillance is less frequent.
4. Mechanical integrity must be maintained by use of the correct part of the equipment, as designed by the equipment supplier.

6057 26 October 1996

Source : EUROPEAN CHEMICAL NEWS, 1996, NOV, 4.

Location : Ludwigshafen, GERMANY

Injured : 0 Dead : 0

Abstract

Two tonnes of formaldehyde flowed into a river after a pipe leaked. Leakage occurred when a rubber seal linking two pieces of pipework failed when pumping the material.

[seal failure, spill, material transfer]

Lessons

[None Reported]

Source : ICHEME

Location : , USA

Injured : 0 Dead : 0

Abstract

A 6 inch untreated/raw naphtha line failed catastrophically near the base of the vacuum tower and the outflow autoignited. Both the reformer and the naphtha hydrotreater depressured in less than 15 minutes through the ruptured pipe. The resultant torch fire and subsequent fires from leaking flanges and pipe failures burned for approximately 10 hours. Two flare connections failed which contributed significantly to the duration of the fire as the plant was being shutdown and depressured to the flare system. Property damage is estimated at \$10 million (£5.9 million) (1996). Commercial loss is estimated at \$20 million (£11.9 million) (1996) as units, not directly affected by fire, were shutdown for weeks and the vacuum tower was down for over two months. An environmental release of FCC catalyst affected areas outside the plant, as the various units were shut down.

Untreated naphtha from the crude units were combined into a single stream prior to introduction into the naphtha hydrotreater. The failure occurred in the line from one of the crude units, downstream of the last exchanger and prior to the point where the two streams join. The naphtha line was at normal conditions prior to the incident at approximately 450 psig and 600 degrees F (317 degrees C). There were no indications from any of the alarms or any of the nearby employees that there was any problem with the line immediately prior to the fire. The piping was originally installed in 1965 and specified as aluminised (or "Alonised" as it is referred to) carbon steel piping. "Alonising" is an old process, no longer in common use for process piping, performed mainly to enhance the resistance of steels to high temperature, high sulfur environments. Although this piping was in service for over 30 years, sections of this same line near the failure had experienced only slight-to-moderate pitting and had retained nearly its original wall thickness.

[pipeline failure, fire - consequence, damage to equipment, autoignition, processing]

Lessons

The following recommendations were made:

1. Ensure that potential corrosion problems are adequately addressed with appropriate expertise and level of management.
2. Develop an action tracking system for all recommendations resulting from investigations, HAZOPS, audits, etc.
3. Re-evaluate piping inspection program.
4. Consider outside review of mechanical integrity program to share and incorporate best practices.
5. Replace alonized carbon steel pipe in high temperature/high sulfur services.
6. Consider amending emergency response plan to include call-out of personnel to assist in operational shutdown of units in major emergencies.
7. Emergency response drills should consider shutdown and isolation procedures and review of location of valves and switches.
8. Review the procedures in place for the emergency operation center and staging area including the need for a checklist and registration of first responders.
9. Develop a site specific plan for industrial hygiene exposure assessment on and off site during emergencies.
10. Review the adequacy of stationary fire protection in heavily congested areas.
11. Review the location, identification and accessibility of emergency isolation valves and switches.
12. Review the adequacy of existing emergency communication and notification systems within the refinery.
13. Make certain inspection thickness monitoring locations are sufficient to detect localized corrosion.
14. Conduct external audits of inspection programs and associated data management systems every 5 years to ensure continual mechanical integrity improvement and sharing of best practices.
15. Review adequacy of fire protection systems in congested areas and particularly for flare lines.
16. Check drainage in plant areas to remove expected quantity of fire water.
17. Ensure that all emergency systems are clearly identified and accessible.
18. Additional operational assistance is required in major emergencies to secure the safe shutdown or operation of other units.

Source : HAZARDOUS CARGO BULLETIN, 1997, JUL.

Location : North Carolina, USA

Injured : 0 Dead : 0

Abstract

A release of 132m³ of propane occurred during a delivery at a bulk storage facility. The incident occurred when during the unloading of a cargo tank into two 113m³ storage tanks, the discharge hose became separated from its coupling at the storage tank inlet connection. The driver shutdown the engine, stopping the discharge pump but could not access the remote closure control to close the internal stop valve.

The excess flow feature of the emergency discharge control system did not function and propane continued to be released from the system. In addition to this the back flow check valve on the storage tank system failed resulting in even greater loss.

[hose failure, spill]

Lessons

[None Reported]

Source : ICHEME

Location : , USA

Injured : 0 Dead : 0

Abstract

An high pressure cooling water supply line ruptured necessitating reduced feed to the FCC. Water hammer shock coupled with bending stress is the likely cause of the failure which is estimated to have cost \$88,000 (£52,700) (1996), of which \$62,000 (£37,100) (1996) was production loss.

The line rupture was discovered when the general operator observed a temperature increase at the FCC second stage drum and sent the general operator to the cooling towers to investigate. When the operator arrived at the cooling tower to investigate the problem, he noticed that both high pressure fans were off and that a small trickle of water was accumulating in the roadway. The operator reset the vibration switches on both fans and attempted to restart them, but he was unsuccessful. After attempting to restart the fans, the operator noticed the pressure pump was also off. He was unable to restart it. By this time the flow of water in the roadway had grown substantially, so the operator began to investigate the source of the flow. Operators noticed that the flow of water returning to the cooling tower basin had significantly decreased and observed a loss in the cooling tower level. To maintain cooling and prevent damage to the low pressure cooling circuit, the high pressure cooling circuit was shut down and firewater was added to the basin. Over the next several hours, fire hoses were connected to heat exchangers in the high pressure cooling circuit to provide a temporary water supply. Once electricians were able to examine the equipment, they found that the 600 amp main electrical breaker 114 degrees C, supplying the high pressure pump and fan, had tripped. They also discovered that another fan had shut down due to vibration, unrelated to the circuit breaker tripping. Approximately half an hour after the main circuit breaker was reset, the high pressure pump started to run on its own, even though its switch was in the off position and it had to be shut off by opening its circuit breaker because it could not be shut off using its stop button. Circulation was re-established at 7:30 pm on August 27 after 64 hours.

After an investigation it was concluded that the immediate cause of the pipe fracture was probably due to water hammer combined with a high localised bending stress.

The basic cause was poor piping design and installation.

A contributory cause was probably faulty electrical equipment that caused a pump to trip off and restart automatically.

[design or procedure error]

Lessons

The following recommendations were made:

1. Water hammer even in large industrial systems can cause severe damage to weak points designed into a piping system.
 2. Old electrical relay equipment requires significant preventive maintenance attention if it is to continue to provide reliable service.
-

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Spill during the transfer of tank bottoms at a refinery.

During a planned transfer of tank bottoms from one tank to another, the hose attached to the pump outlet separated from its flanged connection, releasing a significant amount of tank bottoms. It was found that the non-return valve was fitted in the line the wrong way which created a pressure build-up and led to the hose separating from the flange. In addition, the equipment was not operated in the manner in which the designers and suppliers had intended, and there was no pressure relief in the system using positive displacement pump. The cause was due to the incomplete training of the labour crew since tank bottoming practice had changed requiring flanged fittings and assembly of reducers and a non-return valve onto the tank valve flanges. No training was provided on the set up and operation of the compressor/pump facility. Inadequate policies, procedures, evaluation of loss exposures, specification of design criteria, and evaluation of changes also contributed to this incident.

[material transfer, valve failure, refining]

Lessons

The scenario demonstrates clearly how one wrong item in a chain of events, i.e., the reverse fitting of an NRV led to the incident.

There are probably lessons that all sites can learn; essentially better communication and control of contractor operations.

Source : LLOYDS LIST, 1996, JUL, 29, JUL, 31, AUG, 7. LOSS CONTROL NEWSLETTER, ISSUE 3, 1996.

Location : , MEXICO

Injured : 36 Dead : 9

Abstract

An explosion occurred in a gas plant which was caused by a liquid gas leak. Three explosions were felt several kilometres away from the plant. Two natural gas plants destroyed which were capable of processing 500 million cubic ft per day.

The blasts were caused by a liquid gas leak from a remotely controlled valve during pump out of an LPG bullet for maintenance. Three explosions were felt several kilometres away from the plant. Insurance losses could reach US\$1billion. Initial property damage estimate is some US\$ 250 million with total final loss up to US\$ 1 billion including business loss

[valve failure, damage to equipment, storage equipment]

Lessons

[None Reported]

8628 18 July 1996

Source : LLOYDS LIST, 1996, AUG, 9.

Location : Texas, USA

Injured : 0 Dead : 0

Abstract

A fire occurred at a refinery due to a failed flange and relief valve .

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

Lessons

[None Reported]

Source : CHEMICAL HAZARDS IN INDUSTRY NO: 1, JANUARY 1998.

Location : , GERMANY

Injured : 0 Dead : 0

Abstract

A release of contents of a pressure vessel occurred when a longitudinal weld tore open. The vessel had been shut down and had just been put into use again when the incident occurred.

The gas mixture contained hydrocarbons with 30% hydrogen. It has reached its working pressure of 31 bar, but was only at -26 degrees C, instead of the working temperature of -73 degrees C, no liquid was present.

An investigation found a crack, 1.6 metres long, had formed near the upper end of the weld.

[incorrect temperature, gas / vapour release, weld failure, tank]

Lessons

The following recommendations were made:

All vessels of similar construction to be tested for incipient cracks on the inner surface by using a dye penetration test.

If the interior is inaccessible, welds and impact zones are to be tested by ultrasonic methods.

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

Light ends from the FCC main fractionator were being recovered using a wet gas compressor. Two casing drains from this compressor had thinned through internal corrosion. Engineered box enclosures injected with special sealant had been installed to avoid an untimely shutdown of the compressor. Within 3 weeks of the temporary repair being installed, one of the box enclosures failed releasing high pressure hydrocarbon vapours to the atmosphere. Fortunately, there was no ignition but production losses amounted to \$56,000 (£33,433 (1996)).

Inspection of the temporary enclosure device revealed that the strongback tongue had failed. The tongue (see Figure 6) is designed to hold the leak repair device in position during the sealant injection process and during operation. The tongue is a necessary part of the leak repair device since there exists an unequal axial thrust generated during the sealant injection operation. The tongue is also vital during normal operation because the unequal axial thrust remains after the sealant injection operation is completed. This is due to the physical characteristics of the sealant material that was used. The selected sealant for this application was a thermosetting type which exhibits the characteristic of very little or no shrinkage after hardening. Therefore, whatever forces are introduced into the box enclosure by the sealant injection including the enclosed piping and fittings themselves remains as long as the device is installed. These forces can be significant due to the high injection pressures typically applied during the sealant injection process. Typically, injection pressures are in the order of 1000 to 2000 psig. This pressure is exclusive of the static pressure necessary to create sealant flow through the injection gun.

Representatives of the leak repair contractor responsible for the job were brought in to assist with the investigation into the incident. Both the leak repair contractor representative and a refinery engineer performed independent reviews of the leak repair device configuration, design calculations, material selection and design conditions used. The conclusion from both parties was that the box enclosure was properly designed. The box enclosure with the enclosed flange and piping still intact were sent back to the leak repair contractor's manufacturing facility for further inspection and testing. In addition, a full review of the installation procedure used for this specific application was carried out. According to the leak repair contractor's design calculations for the tongue, an injection pressure of 1300 psig was used to calculate the generated hydraulic thrust. The allowable working load of the tongue was calculated and shown to be 1 1/2 times the hydraulic thrust thus indicating an acceptable design. However, the leak repair contractor's review of the installation procedure used for this job revealed that an injection pressure of 2500 psig was inadvertently used for this application. Given this injection pressure, the generated hydraulic thrust due to sealant injection exceeded the allowable working load of the tongue by a factor of 1.3. The leak repair contractor representative also indicated that there was a sharp transition from the box enclosure to tongue. The excessive hydraulic thrust introduced during the sealant process, the minimal shrinkage characteristic of the type of sealant selected, in combination with a stress riser due to the sharp transition between the tongue and the box enclosure most likely resulted in a fatigue failure in the transition area. This was consistent with visual observations of the failure.

[mechanical equipment failure, gas / vapour release, competency lacking, cracking, pipe, drain]

Lessons

The justification for undertaking this type of temporary repair must be weighed against the potential consequences of failure. Such justifications should be endorsed by senior management on advice from a professional mechanical engineer. When there is justification for such a repair, all aspects of the job must be carefully examined, controlled and implemented by competent personnel.

The following corrective actions were taken:

1. The Leak Repair Contractor has reviewed the injection procedures and trained their technicians to ensure their understanding of the differences in injection mechanics associated with the various types of sealant. This will ensure that the correct sealant injection pressure is applied in future.
2. The Leak Repair Contractor's Engineering Department has reviewed high stress concentrations at the enclosure to tongue transition specifying a minimum radius.
3. Other similarly designed clamps installed have been inspected to ensure that a similar failure will not occur.
4. Inspection will continue to monitor the first and second stage drain piping at 6-month intervals or until a corrosion rate is established for each stage.

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.

8786 22 April 1996

Source : EUROPEAN CHEMICAL NEWS 6, 1996, 5, DEC.

Location : Ludwigshafen, GERMANY

Injured : 0 **Dead** : 0

Abstract

Some 1.5 ton of gaseous butadiene escaped through a ruptured pipe at an 80,000 tonne per year plant. There were no injuries and damage was confined to a 30 cm long crack in the affected pipe.

[damage to equipment, leak]

Lessons

[None Reported]

Source : LOSS CONTROL NEWSLETTER, ISSUE 2, 1996.

Location : Ryazan, RUSSIA

Injured : 0 **Dead** : 6

Abstract

A road building enterprise had rented an obsolete part of the refinery and stored hot liquid bitumen in a 10,000 m³ underground storage facility. It is thought that corrosion and a damaged power cable were involved in the explosion.
[storage equipment, damage to equipment]

Lessons

[None Reported]

Source : LOSS CONTROL NEWSLETTER, ISSUE 2, 1996.

Location : Winnipeg, CANADA

Injured : 0 **Dead** : 0

Abstract

Transportation. A rupture in a 34 inch pipeline sent a fireball over 100 ft high. The cause has been attributed to faulty welding on the pipe.
[weld failure, fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Hydrotreater recycle hydrogen line failure at a refinery.

Localised corrosion of a FCCU (Fluid Catalytic Cracking Unit) feed hydrotreater recycle hydrogen line by-pass around a hydrogen pre-heat exchanger led to an explosion and fire. The failed part of the line had been identified by inspection as a dead leg. After investigation it was found that the mechanism of corrosion was ammonium chloride under deposit corrosion. The source of chloride has not been traced, but hydrogen from the catalytic reformer was strongly suspected. Inspection inadequate of the dead leg was identified as the cause of this incident. There was damage to equipment, material loss and product loss. [refining, fluid cracker]

Lessons

Localised corrosion mechanisms are difficult to detect with fixed point UT, and dead leg corrosion can have several different corrosion mechanisms.

Source : LOSS CONTROL NEWSLETTER, ISSUE 2, 1996.

Location : Tyumen, RUSSIA

Injured : 0 **Dead** : 0

Abstract

Transportation. The fire followed a natural gas leak when the 1,200 mm pipeline ruptured. Several dozen metres of pipeline had to be replaced.
[fire - consequence, pipeline failure]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 1 Dead : 0

Abstract

Shattered sightglass on desalter at a refinery. An operator noticed that the desalter pressure was dropping. When a unit operator went to check the desalter he found the north brine bullseye had shattered, and brine was spraying out under pressure. When recommissioning the north bullseye, after replacement, the south bullseye shattered. A near-by operator was scalded. There was damage to equipment. It was found that the glass disk material was of insufficient thickness to meet the pressure envelope and there had been erosion/corrosion of the glass face.

The glass disks had not been examined/replaced in accordance with manufacturer's guidelines, and there was no assurance that replacement disks were in compliance with material, toughening quality or process design specification.

[scalding, low pressure, spill, refining, gauge glass failure, injury]

Lessons

Clearly glass gauges should receive scheduled attention, since their failure can be catastrophic in terms of flying glass and released contents. Points to watch include the following:

1. Correct commissioning/decommissioning to avoid thermal/pressure shocks.
 2. Use and upkeep of corrosion shields to protect the glass as required against some corrosive chemicals.
 3. Incorporation of "blow out" protection such as balls within sight glasses, and maintenance of such protection guards as deemed necessary.
-

8576 05 March 1996

Source : LLOYDS LIST, 1996, MAR, 8.

Location : Montevideo, URUGUAY

Injured : 0 Dead : 0

Abstract

A fire broke out in a store and warehouse of chemical products. Fire caused by electrical short circuit.

[fire - consequence, storage, warehousing, unknown chemicals]

Lessons

[None Reported]

Source : SEDGWICK LOSS CONTROL NEWSLETTER, ISSUE 1, 1996.

Location : Komi Republic, RUSSIA

Injured : 0 **Dead** : 0

Abstract

Transportation. 60 cum (cubic metres) of crude oil spillage due to faulty seal.

[seal failure]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Coker charge pump seal failure on a refinery. The inboard mechanical seal on a new Coker II Charge Pump failed. When coker feed was released, it auto-ignited.

The flange of the bellows, which is a sleeve made of Invar, had corroded away. The severity of the corrosion was a surprise since the seal had been in service only 6 weeks.

Losses including damage to equipment, product loss and the cost of maintenance amounted to \$21,000 (1996). It was found that the flange of the bellows had corroded away and the seal stationary face separated from the bellows, allowing feed to leak to atmosphere. This was caused by the bellows material being susceptible to high temperature sulphur corrosion, however the engineering data sheet did not quantify the feed components, and the manufacturer had no data to quantify corrosion rates as a function of temperature and sulphur concentration.

[autoignition, material of construction failure, refining]

Lessons

Sulphur concentration needs to be stated on all seal and pump specifications.

8457 24 January 1996

Source : WASTE ENVIRONMENT TODAY, 1996, VOL 3, NO. 3, 1996, VOL 19, NO.10.

Location : Flix, SPAIN

Injured : 0 Dead : 0

Abstract

A leak from a broken valve in the chloroform plant resulted in the release of 5 tonnes of chlorine.

[valve failure, spill, processing]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Safety relief valve fire on residue system. A high flow rate of liquid to a blowdown knock-out drum, allied to its limited pump out facility, eventually caused the drum to overflow. A relief valve in the bottom circuit of the CDU main fractionator opened, but it failed to close as counter measures were taken. A decision was made to have personnel wearing protective clothing clamp the passing relief valve. When the screw in the bonnet of the relief valve was removed, a jet of hot residue was released and ignited. An investigation of the failed relief valve revealed a broken spring, attributed to a material defect. The spring was not from the valve's manufacturer; rather, it was a copy, manufactured by and obtained from another company. As far as could be ascertained this other company does not use tested materials or have facilities for conducting crack testing on the manufactured springs.

[flow rate too high, overflow, valve failure, testing inadequate, fire - consequence]

Lessons

It is important that quality certified materials are used for process equipment.

Manufactured springs must undergo crack testing.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Catalytic poly sample cooler failure and fire. A piping coil at the water to air interface of a sample cooler, off a depropanizer reboiler in the Cat Poly Unit, failed. Hydrocarbons were released which ignited resulting in a substantial fire. The sample cooler was used only occasionally to draw samples. There was damage to equipment and material loss. It was found that aqueous corrosion of the carbon steel pipe had occurred. During normal operation, the block valves were to be in the closed position for all sample coolers; on the day of the failure, all the block valves were in the open position. This incident was caused by inadequate inspection frequency.

[inspection inadequate, fire - consequence, cooling equipment, mechanical equipment failure, processing]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

A 5500-m3 floating roof tank failed catastrophically during filling operations. The tank was being filled with water for the final water test subsequent to repairs. Fortunately no one was seriously injured.

The tank shell ruptured over the full height of the tank and the sudden release of about 5000-m3 water caused extensive material damage to pipework and 2 other tanks in the same bund.

An investigation into the incident found a tensile fracture "zip failure" due to thinning of the tank shell caused by corrosion. This corrosion was found as concentrated vertical grooves and pitting on the inside of the tank. Scratching by the rim seal brackets, fixed to the floating roof pontoons have contributed to the groove formation and "accelerated" corrosion of the tank shell. The absence of the so-called bumper bars on the floating roof pontoons allowed the brackets to touch the tank shell.

[tank failure, loading, damage to equipment]

Lessons

[None Reported]

124281996

Source : ICHEME

Location : ,

Injured : 6 **Dead :** 3

Abstract

An explosion occurred in a plant. The incident occurred when a block valve failed, resulting in the release of liquid propylene. The explosion occurred shortly after the release.

Three people were killed and six others seriously injured.

The cause of the incident is not known but an investigation is to be carried out, although it is thought that the insert of the valve became dislodged during maintenance work and that the internals were blown out from the valve body.

[valve failure, spill, fatality, injury]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

The failure of a crude oil bypass line at a refinery. The crude oil bypass line on the CO1 exchangers on a crude unit failed, and there was a release of crude oil. There was damage to equipment. It was found that there had been severe localised chloride induced under deposit corrosion. Contributing to this was an incorrect unit throughput set point caused by an abnormal increase in line pressure. The area of failure was not easy to access/monitoring and in fact, the line had been leaking for a period of time prior to failure. There was a stagnant area, dead end between the isolation block valve and the main line (as it was not self draining), which allowed the build-up of crude sludge.

[refining]

Lessons

Corrosion to the point of failure in stagnant sections of pipelines is not always easy to detect at early stages and HAZOP and inspection procedures need to assess requirements.

Control limits on operating parameters may need to be fixed to avoid entering potentially hazardous zones in error.

Source : LLOYDS LIST, 1995, DEC, 29,; THE CHEMICAL ENGINEER, 1996, JAN, 11.

Location : Plaistow, East London, UK

Injured : 0 **Dead** : 1

Abstract

A worker was killed in an explosion at a sugar factory. The incident occurred when the crown valve was being opened to a low pressure boiler (150 psig) when the valve cracked and a blast of steam hit the worker. Fatality.

[valve failure]

Lessons

[None Reported]

Source : LLOYDS LIST, 1996, JAN, 13, JAN, 26.

Location : Komi Region, RUSSIA

Injured : 0 **Dead** : 0

Abstract

Transportation. Pipeline ruptured causing spillage of 2,800 barrels of crude oil. The rupture was attributed to corrosion. Oil polluted river.
[pollution]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 6 Dead : 3

Abstract

Ball valve blow-out on propylene system. A ball valve failed and released liquid propylene, which lead to an explosion. The incident was caused by the ball valve being fitted in the wrong direction. There was damage to equipment damage and material loss. Fatality.

[valve failure, installation inadequate, product loss, maintenance]

Lessons

Maintenance workers must be trained not to attempt to work on any item with which they are not 100 percent familiar as to its construction, and when necessary to seek information before starting, if they have any doubts. Supervision must play a vital part in ensuring that those instructed to do a job are provided with the correct information to avoid incidents. Manufacturers drawings unfortunately sometimes leave much to be desired, which means that someone with first-hand experience of the item is very valuable in preventing incidents.

8235 22 November 1995

Source : LLOYDS LIST, 1995, DEC, 7.

Location : Tyumen Region, RUSSIA

Injured : 0 **Dead** : 0

Abstract

Transportation. A gas explosion and subsequent fire occurred at a pipeline causing damage of Roubles 4.3 billion. Accident caused by the erosion of a 500 mm pipe. A total of 240 metres of pipeline and an engine room were wrecked.
[fire - consequence, damage to equipment]

Lessons

[None Reported]

Source : SEDGWICK LOSS CONTROL NEWSLETTER, ISSUE 4, 1995.

Location : Yekaterinburg, RUSSIA

Injured : 0 **Dead :** 0

Abstract

Transportation. An explosion occurred when gas pressure built up to 30 atmospheres when valves at the station were shut off. The cause of the explosion was originally attributed to sabotage but later suggested that it was caused by corrosion of the pipeline.

Lessons

[None Reported]

8224 29 October 1995

Source : BBC NEWS, 1995, OCT, 30.; CHEMISTRY IN BRITAIN, 1995, DEC.

Location : Dagenham, Essex, UK

Injured : 0 Dead : 0

Abstract

Release of 12 tonnes of hydrogen chloride from 30 ton tank resulted from a faulty valve. The gas passed over during the evening. Leak.
[valve failure, gas / vapour release]

Lessons

[None Reported]

Source : SEDGWICK LOSS CONTROL NEWSLETTER, ISSUE 1, 1996.

Location : , KUWAIT

Injured : 0 Dead : 0

Abstract

One of two strings of hoses parted during loading of 350,000 dwt tanker. Up to 800 tonne crude oil spillage occurred.
[hose failure]

Lessons

[None Reported]

Source : ICHEME

Location : , USA

Injured : 0 Dead : 0

Abstract

A serious fire occurred on a drier. The fire was first spotted in the dryer exhaust duct and up into the exhaust fan and ductwork on the top of the drier. The fire was difficult to extinguish because of poor access and the extreme heat in the middle of the drier. The CO2 system was set off three times and fire hoses were used extensively before the fire was brought under control. Other problems encountered in the incident were:

1. Inadequate availability of SCBAs and spare bottles.
2. Poor location of clock-out machines.
3. Inadequate visibility for fire fighters caused by lack of lights on drier roof.
4. Poor access to top of dryer because of congestion at ladder.

The root cause was not established. Possible causes were:

1. Material build-up in the ductwork ignited by overheating or a spark.
2. Overheating elsewhere not detected by instrumentation.

[fire - consequence, normal operations]

Lessons

The following actions were suggested for consideration:-

1. Improve access to ducts to allow fire fighters to get firewater inside ducts.
 2. Change out ducts when build-up is considered excessive.
 3. Install temperature sensors in ductwork.
 4. Consider sprinklers inside ductwork (manual or automatic).
 5. Keep spare ducts ready for quick replacement.
 6. Check ducts are correctly labelled.
-

Source : SEDGWICK LOSS CONTROL NEWSLETTER, ISSUE 4, 1995.

Location : Rafnes, NORWAY

Injured : 0 Dead : 0

Abstract

An explosion occurred due to ignition of gases during testing of a furnace operating system. The flame detection system interlocked to the gas supply was defeated. Substance involved: ethylene.

[instrumentation failure gas oil]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Failure on new gas compressor. A valve cover on the suction side of a recently commissioned reformer blew off. Process technicians who were working in the area were alerted by the noise of escaping gas. Their prompt investigation quickly identified the cause of the gas release; and the unit was shut down by activation of the emergency shutdown system in central control. It was found that the studs on the valve cover failed in fatigue, the result of not having all be torqued to the specified level. The cause of the accident was the manufacturer not communicating the criticality of even torquing of valve cover studs and not including the checking of valve cover studs in its "field installation checklist".

[metal fatigue, inspection inadequate, processing]

Lessons

The need for stud/bolt torquing on flanges and other closures requires engineering assessment at installation and subsequent maintenance actions, taking account of system parameters and criticality.

Source : HAZARDOUS CONTROL BULLETIN, 1995, OCT.

Location : Lowestoft, Suffolk, UK

Injured : 0 **Dead** : 0

Abstract

Suspect weld on 9,900 litre tank container caused half of contents of hydrochloric acid to leak. Spillage washed down.

[weld failure]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Oil spill at a refinery. During the transfer of base oil from one storage tank to another, a flexible hose failed, resulting in a spill of 250 tonnes. The cause of this incident was continuous utilisation of the hose at a pressure very close to its maximum working pressure.

[material transfer, storage tanks, hose failure, overpressurisation]

Lessons

Hose selection requires careful consideration as regards maximum operating pressures to be used, frequency of use and testing, handling methods, and curvature in use.

Source : ICHEME

Location : , USA

Injured : 0 Dead : 0

Abstract

A tube suddenly ruptured in a reactor feed preheat furnace of a Resid Hydrotreater and resulted in a major fire. The mechanism of failure was creep in a relatively localised area. The incident occurred during the start-up of the unit.

The 96 Mbbpd Resid Hydrotreater started operation in late 1983. It consists of three parallel modules feeding a common distillation section. Each of the modules is identical, and contains two parallel reactors, feed/effluent heat exchanger, one preheat furnace, hydrogen recycle and quench, and product separation and cooling. Each furnace has two separate radiant sections which preheat the feed to the two parallel reactors. Each radiant cell of the furnace preheats a mixture of resid feed and hydrogen to its feed temperature. Twenty-two furnace tube skin temperature indicators (TIs) are provided throughout each radiant cell. Peepholes are provided at each end of the 60 foot long firebox and at three locations along each side of the firebox. The tubes are seven inches in diameter, 0.6 inch in nominal thickness and of type 347 stainless steel.

On the day of the incident, the fuel gas valve on the furnace's north cell was fully open at a rate of 43,000 scfh from about 00:30-02:35 hrs., and the south cell was also fully open at the same rate from approximately 01:25-02:35 hrs. An operator inspected the furnace during this period and noted no obvious hot spots on the tubes or other abnormalities. Fuel gas was reduced to both cells prior to shift change to lower the skin TIs (one skin TI in the north cell reached alarm point of 1050 degrees F at 05:30 hrs.). The skin TIs cooled to 850 degrees F (454 degrees C) or less but the one TI which had alarmed remained at 950 degrees F to 1000 degrees F (510 degrees C to 538 degrees C). At no time during the startup did any TI reach the maximum design limit of 1100 degrees F (593 degrees C). surveys have revealed temperatures high enough to cause a creep failure.

Key findings from the investigation are summarized below.

1. Coke deposition occurs predominantly at or near tube welds in the furnaces.
2. The weld acts like a stiff ring - such that when creep conditions exist in the weld area the tube bulges where the resistance to stretch is less (4 inches from weld).
3. Weld thermal stabilization did not remove residual stresses from the weld to the edge of the heating blanket, test shows that after post-weld heat treatment negligible residual stresses remain.
4. The grooves found in the north cell tube 4 failure point were statistically equivalent to the grooves found in the south cell tube 12 bulge and most likely occurred from the same mechanism.
5. The grooves were not a manufacturing defect because the grooves in the south cell crossed a weld.
6. The internal grooves were a consequence of carburization and creep (very similar to boiler tube ruptures due to creep and Environmental factors such as scale).
7. There was no evidence of tube material degradation near the welds.
8. Short term stress rupture tests on tube material indicated properties at or slightly below the API 530 minimum rupture curve.
9. Due to several locations of creep characteristics being found, the overheating is most likely due to chronic conditions rather than any single event.
10. Full tube inspection, visual or IR, was not possible with the existing number of sight ports.
11. Localized overheating of the tube was not indicated by skin TIs, periodic infrared scans, or visual inspections.
12. Furnace operating policy, at the time of the incident, was to fire the furnace subject to tube skin TI, draft, CO, excess O2 and flame pattern constraints. Heat flux or fuel gas limits had not been imposed.

[reactors and reaction equipment, fire - consequence, separation equipment, cooling equipment]

Lessons

The following recommendations were made:

1. Decoking of furnace tubes to prevent coke build up and consequent localised heating should be undertaken at specified intervals.
2. Tube skin temperature alarm points should be set sufficiently lower than the maximum design temperature to allow for hot spots or localised heating.
3. IR imaging needs to be conducted frequently to supplement tube skin temperature measurements.

1700 29 July 1995

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

Location : Rapid City, Manitoba, CANADA

Injured : 0 **Dead** : 0

Abstract

Transportation. Escaping natural gas from a pipeline break caught fire and burned itself out after the break was isolated by closing valves either side of the break. Stress corrosion cracking was possibly a cause.

[fire - consequence, leak]

Lessons

[None Reported]

3828 28 July 1995

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

Location : Santa Fe Springs, California, USA

Injured : 19 **Dead** : 0

Abstract

A pump in a bleach manufacturing plant broke down, spilling liquid chlorine that developed into a release of a toxic cloud.

[gas / vapour release, pump failure]

Lessons

[None Reported]

1516 17 July 1995

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

Location : Samotlor Field, Tyumen, RUSSIA

Injured : 0 **Dead** : 0

Abstract

Explosion in field was caused by the rupture of a pipeline due to corrosion. Spillage of oil covered 500 sq. metres.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Depentaniser bottoms pump failure. A fire started in the seal area of the depentaniser pump, fuelled by leaking process fluid.

It was found that the pump's bulb drain plug had fallen out and the loss of oil caused overheating and failure of the pump bearings, eventual deformation of seal and subsequent product leakage. When the plug was removed for maintenance, at some time, it was not completely re-inserted. Over a period of time, the plug backed out of the housing, probably due to vibration.

[fire - consequence, processing]

Lessons

Checking for system tightness is essential on equipment, such as pumps, after maintenance, including oil changes. Records should be available of maintenance, lube oil changes, etc. to establish pump history.

Adequate pump isolation facilities e.g., remotely actuated and protected isolating valves are usually recommended for hydrocarbon duties depending on characteristics of fluid being pumped (volatility, toxicity, temperature, etc.).

Deluge systems need to be regularly tested and flushed through, and pipe work and nozzles preferably constructed of materials not subject to corrosion and blockage.

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

An 8 inch line on a carbon disulphide plant fractured and a 9 metre diameter fireball resulted. The line was carrying a mixture of carbon disulphide, hydrogen sulphide and methane at 600 degrees C between the furnace and the reactor. The fire was brought under control by shutting down production and allowing it to burn out in a controlled manner. The incident caused release of sulphur dioxide to the environment and loss of production. Damage to plant was minimal and there were no injuries.

The cause was unknown at the time of the report. The pipe failed at the heat affected section close to a weld. It had been in service for at least 12 years and was due its next two-yearly inspection in September 1995. Ultrasonic thickness tests on the failed pipe revealed inconsistencies with the results from September 1993. The appearance of the failed section of pipe differed substantially from the remaining sections.

[fire/explosion, fire - consequence, mechanical equipment failure, reactors and reaction equipment, material transfer, gas / vapour release, material of construction failure]

Lessons

1. A major incident had occurred and only good fortune prevented serious casualties and potential escalation of the incident.
 2. The shift team dealt with the incident effectively.
 3. Their task could have been eased if emergency procedures had been clarified and rehearsed. In particular the workload of dealing with incoming telephone calls at a time of intense activity was a problem.
 4. The frequency of examination on some pipelines on hazardous duty was inadequate and failed to reveal a section of pipe which was below specification.
-

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]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Residue hydrocracker fire. A 6 inch schedule 40, carbon steel elbow ruptured; and a fire resulted. It was found that the pipe failed due to erosion/corrosion. The cause was due to failure to apply management of change procedures to the decanted oil injection that identified erosion as a possible consequence of the decanted oil injection. No metallurgy upgrades or additional inspections were recommended as a result. Loses \$2.5 million (1995) (£1.59 million) (1995), including damage to equipment. [fire - consequence, cracking, management system inadequate]

Lessons

The cumulative impact on the materials of construction from gradual changes in process conditions, e.g., flow rate, temperature, sulphur content, can, unfortunately, be overlooked if the threshold values are not established to provide a base line for comparison.

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 : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Drain line failure on catalytic reformer on a refinery. During the application of a temporary clamp over a pin-hole leak, a drain line from the level switch bridle on the catalytic reformer compressor dry drum failed catastrophically. There was a gas release; but it, fortunately, did not ignite. There was damage to equipment and product loss.

It was found that the wrong type of sleeve was fitted to the line, and that excessive tensile load was applied to line during injection of compound. The basic cause was that the sleeve was not approved prior to installation as required by procedure.

The procedures did not specifically address the possibility of over stressing from hydraulic effects.

[gas / vapour release, installation inadequate]

Lessons

The task of temporary repair to pipework using the "Furmanite" injection technique is a highly technical one which requires a sophisticated level of control to avoid disasters.

Source : SEDGWICK LOSS CONTROL NEWSLETTER, ISSUE 4, 1995.

Location : Botany Bay, AUSTRALIA

Injured : 0 **Dead** : 0

Abstract

The release of liquid butane occurred when it was trapped behind a faulty valve during a maintenance shutdown.

[leak, valve failure]

Lessons

[None Reported]

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

Location : Usinsk, Komi Republic, RUSSIA

Injured : 0 **Dead :** 0

Abstract

Major pollution occurred in this marsh area following failure of a corroded pipeline in 1994. During May 1995, clean up operations, an attempt to burn off excess oil, resulted in an uncontrolled fire, which spread over 10 hectares of the 25 hectares spillage area. Significant environmental impact is anticipated when the Spring thaw arrives.

[pipeline failure, fire - consequence, corrosion, spill]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

During discharge of solid flake from a bulk tanker, sparks were observed on the outside of the discharge flexible hose. The discharge was stopped immediately and the vehicle disconnected and sent away part discharged. There were no other consequences. The hose was translucent plastic with internal carbon steel wire armouring. Continuity had been lost between this and the metal coupling on the end of the hose. The hose had been supplied as having anti static properties but was not subject to regular continuity testing. This was because it belonged to the transport department and not the production plant. The SOP for the operation was also out of date, being for a "walking floor" type of vehicle. This had not been used for between 18 months and two years at this site. The operation had been carried out many times without incident.

The main recommendations were:

1. Procure two new anti-static hoses to be the property of the Plant.
2. Include earth continuity checks in the engineering department schedule.
3. Revise and re-issue the SOP.
4. Circulate Company guidance note on "Rules and Procedures for Sources of Ignition" to all relevant businesses in Group.

[unloading, road tanker, near miss]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Crude distillation unit fire and shutdown at a refinery. Piping on the bottom of the desalter safety valve outlet header, adjacent to the crude tower, failed. Hot oil was released and ignited. There was damage to equipment and product loss.

It was found that hot oil corrosion along the bottom of safety valve discharge piping header led to failure of the piping. The basic cause was failure to identify the hazard presented by process conditions, both at the original design process and the subsequent review.

[fire - consequence, valve failure, spill, design or procedure error, refining, oil - hot]

Lessons

Design standards for pressure relief valve piping must take into consideration different process conditions (in this case, no flow).

Source : ICHEME

Location : , UK

Injured : 3 Dead : 0

Abstract

Three staff were affected by fumes in two separate episodes on a site where NaHS tanker loading took place. In the first episode two gatehouse staff complained of lachrymatory fumes during the afternoon. On checking it was found that during NaHS tanker loading, the tanker vent scrubber pump was not running. It was restarted but the lachrymatory fumes persisted well beyond the 30 minutes required to load a tanker.

A second, related, episode occurred at 18:30 that evening. The night-duty man was affected by fumes. At 20:00 the fumes were gone but the man reported sick the following day with symptoms typical of H₂S exposure.

It was later discovered that a catchpot on the NaHS plant was being drained at 18:30. The procedure was to use breathing apparatus and drain the pot until gas came out as the only indication that the pot was clear of liquid. The drain line was 2 inches in diameter and the system pressure was 5 psi. At one time the drain discharged below the surface of liquid containing bleach in a sump but following plant modifications this was no longer the case. The night-duty man's exposure was attributed to the puff of H₂S released in this operation.

[hydrogen sulphide, gas / vapour release, pump failure, road tanker, draining, people]

Lessons

Actions proposed were:

1. Modify the catchpot sight glass to allow it to be drained while still leaving a few inches of liquid as a seal;
 2. Modify the drain line to allow it to dip into the sump;
 3. Carry out the HAZOP study of the NaHS plant due in June 1995.
-

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A gasoline spill. A threaded fitting on a storage tank of premium grade gasoline failed, resulting in the release of approximately 432 bbls. into the diked containment area.

It was found that the product receipt line between the tank valve and the tank sidewall had failed due to stress on the line from tank and/or pipeline settlement. The type of line in use had a history of failure; newer engineering standards call for use of a different pipe. Also the tank receipt line was not designed to allow for settlement.

[mechanical equipment failure, storage tanks]

Lessons

It is important for front-line staff to visually inspect facilities, particularly at facilities with low staff levels.

Practice and simulated drills help to ensure that company personnel, local fire/emergency personnel and support contractors work closely together in emergencies.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Isocracker heat exchanger flange leak at a refinery. An Isocracker Unit was shutdown due to a small pinhole leak found in the first stage feed/effluent exchanger outlet piping. After disassembly of the piping system, the flange revealed extensive cracking.

Losses including damage to equipment, product loss, and materials and labour amounted to \$1.3 million (1995). It was found that chloride stress corrosion cracking caused the incident. All four criteria for chloride stress corrosion cracking were present: Material of cracked flange was austenitic type stainless steel, known to be vulnerable to chloride cracking. Flanges were overcompressed and the joints had not been hydraulically torqued during previous turnaround. Even low overall concentration of chlorides got into grooves and pits during cycling and went undetected for many years/cycles.

[refining, cracking]

Lessons

Chloride stress corrosion cracking propagates during start-up and shutdown periods, even in low overall concentrations of chloride, concentrating in grooves and pits.

8112 19 April 1995

Source : LLOYDS LIST, 1995, APR, 26.; HAZARDOUS CARGO BULLETIN, 1995, JUN.

Location : Near Megion, Tyumen Region, RUSSIA

Injured : 0 **Dead** : 0

Abstract

Transportation. Corrosion in pipeline caused a spillage of 1,000 tonnes of crude oil covering an area of 30 hectares.

Lessons

[None Reported]

Source : ICHEME

Location : , USA

Injured : 0 Dead : 0

Abstract

A release of about 2000 lbs of 50% caustic soda occurred on a rayon plant. The material was lost from a broken high level equalisation/overflow line on the 50% caustic storage area when a pump stopped and ran backwards following a breaker failure. The spill was largely contained within the containment that was in the process of being constructed for the tanks in question. A contractor was called in to pump the free liquid to the waste water treatment plant and to excavate the contaminated earth. Despite a full review and additional precautions (unspecified) a second spill of about 10,000 lbs occurred two days later before permanent measures could be taken. This was largely contained within the hole excavated after the first incident and was similarly dealt with. There were no injuries or external environmental consequences but because of the size of the spills they were reported to the appropriate local, State and national bodies.

[pump failure, material transfer]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, 1995, JUN.

Location : Silver Bay, Minnesota, USA

Injured : 0 **Dead** : 0

Abstract

Burning oil sprayed from pipe destroyed electrical cables following pelletiser bearing failure. Two furnaces shut down for up to 3 weeks.
[damage to equipment, processing]

Lessons

[None Reported]

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

Location : Carteret, New Jersey, USA

Injured : 0 **Dead** : 0

Abstract

A 2 hour fire raged at this gasoline storage terminal after a pipe connected to a 2 million gallon gasoline tank failed. Some nearby toll operators were taken to hospital after inhaling toxic fumes.

[fire - consequence, tank failure]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, 1995, APR.; CHEMICAL HAZARDS IN INDUSTRY, 1995, JUN.

Location : Offenbach, GERMANY

Injured : 2 **Dead** : 0

Abstract

A small dust explosion occurred as naphthol powder was poured from metal container into blender. The stirrer was not working at the time of the incident. The cause of the incident is not known but is thought that an electrostatic spark may have ignited the dust. One worker suffered 10% burns and another suffered slight injuries.
[material transfer, injury]

Lessons

[None Reported]

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

Location : Veracruz, MEXICO

Injured : 0 **Dead** : 0

Abstract

A small fire was extinguished within 15 minutes, following a pipeline failure.

[fire - consequence]

Lessons

[None Reported]

8498 23 January 1995

Source : LLOYDS LIST

Location : Usinsk, Komi Republic, RUSSIA

Injured : 0 **Dead :** 0

Abstract

Transportation. 300 tonnes of oil was spilt from corroded pipeline.

[corrosion, spill]

Lessons

[None Reported]

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

Location : Rome, ITALY

Injured : 0 **Dead** : 0

Abstract

A fire broke out in refinery following a pump failure, causing damage to one of the columns. Output unaffected.

[fire - consequence, damage to equipment, refining, processing]

Lessons

[None Reported]

8492 12 January 1995

Source : LLOYDS LIST, 1995, JAN, 17.

Location : , GULF OF MEXICO

Injured : 0 Dead : 0

Abstract

Valve rupture led to spillage of 255 barrels of a mixture of gas, oil, water and sand. Spill contained.

[valve failure, offshore]

Lessons

[None Reported]

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

Location : Off New Orleans, Louisiana, USA

Injured : 0 **Dead** : 0

Abstract

Valve failure led to spillage of 38 cum (cubic metres) of crude oil to sea.
[offshore]

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.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Fired heater tube failure. A heater tube failed during the start-up of a naphtha hydrotreater unit, causing damage to equipment and product loss. It was found that a liquid seal stopped flow while heater was firing and the tube failed due to ductile overload/severe overheating (blockage). The incident was caused by changes to process conditions and modifications to unit that led to the development of liquid seals.
[tube failure, design or procedure error]

Lessons

Modifications to process design conditions and equipment must be subject to technical assessment and safety review.

Fired heaters require adequate instrumentation to ensure that overheating/uneven heating of tubes does not occur, e.g., individual pass flow and temperature monitoring, skin thermocouples, etc.

Source : ICHEME

Location : ,

Injured : 1 Dead : 0

Abstract

Asphalt release from blowing tower at a refining company.

An operations technician was burned by hot asphalt, released from a lifted rupture disc located at the top of the asphalt blowing drum. Overpressure in the blowing drum caused the rupture disc to lift and asphalt to be released. The basic cause was that the blown asphalt unit was operated outside designed operating parameters. In addition there was a lack of knowledge and inadequate written procedures which permitted abnormal operation and led to the malfunctioning of instrumentation and mechanical equipment.

[overpressurisation, instrumentation failure, mechanical equipment failure, design or procedure error, spill, refining, burns]

Lessons

Operators of asphalt (bitumen) blowing units need to have sufficient understanding of the chemistry of the process to appreciate what can result from changes in blowing air and the limitations of instrumentation.

Source : LOSS PREVENTION BULLETIN, 130, 8-10.

Location : ,

Injured : 0 Dead : 0

Abstract

During a routine relief stream inspection two bursting discs were discovered in one holder. It is believed that the two discs were installed during commissioning two years previously.

The incident occurred on a research plant which was commissioned in 1993. The two discs were discovered during the first routine, two yearly inspection of the relief streams in 1995. Pressure systems records confirm that there was no interim replacement of the discs on this relief stream, so that the two discs were almost certainly installed during commissioning in 1993.

The bursting disc holder and five discs were purchased by the project team from a reputable manufacturer. The discs were 0.625 inch (1.59 cm) diameter, thickness 0.004 inch (0.1 mm) with a burst pressure of 120 bar at 300 degrees C. The holder was passed to the construction contractor for installation on the plant and the five discs were retained by the plant supervisor.

Following normal commissioning practice, the bursting disc was installed by a plant fitter. This involved removal of the holder from the plant, dismantling it in the workshop, reassembly of the holder with the disc in place and installation on the plant. Installing the disc in the holder was therefore done in clean workshop conditions. The disc, which is individually packed in a cardboard box, was supplied by the plant supervisor.

Following the incident the four discs remaining from the original order were found in the plant store. Discs of this type are not used elsewhere on site and it is most unlikely that similar discs were available in the workshop.

The two discs that were found during the routine inspection were a very close fit together and were difficult to separate. Most observers were not able to detect the double disc. The four remaining discs were checked, by measuring the metal thickness on the flange, and all found to be single.

[incorrect equipment installed, installation inadequate]

Lessons

The following recommendations were made:

1. The incident should be raised again with the supplier, seeking a more formal and authoritative reassurance that their procedures can prevent repetition.
 2. Share information about the incident through Safety Departments and Engineering Departments both inside and outside the company.
 3. Implement a procedure for checking discs before installation.
 4. Include the requirement for checking the disc on the 'Scheme of Examination for the relief stream'.
-

124261995

Source : ICHEME

Location : ,

Injured : 0 Dead : 1

Abstract

An incident occurred when a specialist piling sub-contractor was carrying out operations at a construction site. As a pile was being hoisted prior to driving, the hoisting sling slipped from the pile. The pile fell onto the driver's cabin, crushing it and killing the driver.

An investigation into the incident revealed that the pile had slipped as a result of tension being lost in the hoisting wire and sling during the dragging and lifting operations. In addition the inspection of the rig revealed signs of wear and tear that indicated that work methods had been in use that were not compatible with the design of the rig.

[lifting equipment, fatality, incorrect equipment installed, additional incorrect operation, transport]

Lessons

[None Reported]

124231995

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A fire occurred in a high vacuum unit. The fire was caused by the melting of the body gasket of a stainless steel non-return valve in high temperature service, followed by the release of hydrocarbons above autoignition temperature.

Fortunately no one was injured in the fire and damage to equipment was limited.

An investigation into the incident revealed that the gasket of the non-return valve, provided by a stockist, was made of teflon rather than spiral-wound as specified in the requisition. Subsequent inspection showed that, in spite of a written compliance confirmation from the supplier, all non-return valves and gate valves installed during maintenance had been supplied with the wrong gaskets.

[fire - consequence, modification procedures inadequate, gas / vapour release, incorrect equipment installed]

Lessons

[None Reported]

8451 20 December 1994

Source : HAZARDOUS CARGO BULLETIN, 1995, FEB.; LLOYDS LIST, 1995, JAN.

Location : Louisiana, USA

Injured : 0 **Dead** : 0

Abstract

Transportation. Pipeline ruptured in a river between two other rivers. 320 tonnes of gasoline spilt from 20 inch line.
[pipeline failure, spill]

Lessons

[None Reported]

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

Location : Louisiana, USA

Injured : 0 **Dead** : 0

Abstract

Transportation. 2000 barrels of gasoline escaped following a failure of a 20 inch gasoline product pipeline which runs across the USA.
[pipeline failure, spill]

Lessons

[None Reported]

1196219 December 1994

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A gasket failure occurred on a pipeline supplying acetone to a plant, releasing approximately 300 kilos of liquid into the workplace. The spill was contained and residual liquors collected for safe disposal.

Lessons

[None Reported]

6791 18 December 1994

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

Location : Martinez; California, USA

Injured : 0 **Dead** : 0

Abstract

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

[fire - consequence, refining]

Lessons

[None Reported]

6790 16 December 1994

Source : LLOYDS LIST, 1994, 17 DEC.

Location : Binh Dinh, VIETNAM

Injured : 0 Dead : 0

Abstract

A hose from a marine tanker to a storage tank broke off causing a spill of 37000 litres of diesel into the sea.

[hose failure, material transfer]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 126, 3-6.

Location : ,

Injured : 13 Dead : 0

Abstract

A breakdown of operations occurred on plant which was caused by the bursting of an acrylic acid tank. This resulted in a large-scale fire fuelled by the escaping acrylic acid/polyacrylic acid. The polyvinyl alcohol storage facility nearby also caught fire

The following combination of events lead to the accident:

1. A power supply failure.
 2. External temperature of around 5 degrees C, with a north wind.
 3. The open-topped building.
 4. Crystallising out by the acrylic acid in both pipeline circuits.
 5. Warming-up and polymerisation caused by the pump working against a blocked delivery route.
 6. Thawing of the crystallised acrylic acid in the bypass pipeline.
 7. Transfer of polymers into the acrylic acid storage tank.
 8. Slow warming of the tank's contents by around 0.5 degrees C/hr due to the pump passing against a throttled valve,
 9. Ineffectiveness of the temperature monitoring system, since the large circulation pipeline remained blocked all the time.
- [cold weather, rupture, fire - consequence, polymerisation, chemical missing, instrumentation failure, temperature meter/control]

Lessons

The following safety procedures were introduced to avoid the reoccurrence of a similar incident:

1. A continuous independent temperature measurement of the tank contents will be provided.
 2. The circulation pump will be equipped with a temperature control safety switch.
 3. Safeguards put in place to ensure that temperatures in acrylic acid storage facilities and in rooms containing acrylic acid pipelines do not fall below a certain level. This will avoid crystallisation of the acrylic acid in the event of a power failure.
 4. Analytical surveillance will ensure that the inhibitor concentration within the acrylic acid does not fall below 200 ppm.
 5. A measuring device will be installed to monitor the throughput of the major pipework.
 6. An emergency reaction inhibition system will be installed.
-

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

Location : Kozloduy, BULGARIA

Injured : 0 **Dead** : 0

Abstract

Major breakdown following a short circuit in a circuit breaker of the main switchboard at this nuclear power plant.

Lessons

[None Reported]

6766 16 November 1994

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

Location : St Croix, VIRGIN ISLANDS

Injured : 0 **Dead** : 0

Abstract

A blown pump seal caused a fire. Substance crude oil.

[seal failure, fire - consequence]

Lessons

[None Reported]

6722 10 October 1994

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, OCT.; LLOYDS LIST, 1994, 11 OCT.

Location : Golabovo, BULGARIA

Injured : 20 Dead : 8

Abstract

Metal side of boiling water reservoir at a coal fired power station cracked and spilled boiling water. Fatality.

Lessons

[None Reported]

6711 October 1994

Source : LLOYDS LIST, 1994, 25 OCT., 27 OCT., 28 OCT., 5 DEC., & 27 DEC.

Location : Usinsk Area, RUSSIA

Injured : 0 **Dead :** 0

Abstract

Major pipeline ruptured, due to corrosion, causing a spill of crude oil over 14400 sq m area. 120 000 tonnes of oil spilt over tundra causing river pollution.

Lessons

[None Reported]

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

Location : ,

Injured : 0 Dead : 0

Abstract

After discovering a nest of ants while replacing a roof section, a small amount of gasoline was poured on the nest. Later that morning, sparks from a grinding operation on the roof ignited the gasoline residue. Workers on the scene quickly extinguished the small fire, with no visible damage to the roof.
[fire - consequence, hot work]

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.

Gasoline should not be used for any purpose other than as a fuel.

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.

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, OCT.; LLOYDS LIST, 1994, 12 OCT.

Location : Toledo, USA

Injured : 0 Dead : 0

Abstract

A spill of 63000 gallons of asphalt occurred when transferring from barge to inland storage tank. A weld had split in the underground pipeline contaminating ground and drains and then a river. 4200 gallons (other report 24000 gallons) solidified in river bed.
[material transfer, weld failure]

Lessons

[None Reported]

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

Location : Eastham; Wirral, UK

Injured : 0 **Dead** : 0

Abstract

Second leak of chloroform in 8 years caused by faulty seal.

[seal failure, spill]

Lessons

[None Reported]

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

Location : Usink; Komi, RUSSIA

Injured : 0 **Dead** : 0

Abstract

Transportation. Series of leaks in badly corroded pipeline led to a spill of crude oil and pollution.

[corrosion]

Lessons

[None Reported]

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

Location : ,

Injured : 0 Dead : 0

Abstract

This incident occurred during the application of a polyurethane foam and a silicone finish to the roof of a vacant building. Shortly after workers applied a perimeter coating of silicone, a spark from a nearby welding operation ignited vapour from the coating. A worker immediately used a fire extinguisher to put out the fire. The site superintendent and the fire department were notified, but further assistance was not required. The damaged section of roof was repaired the same day, and all welding activities were suspended until work on the roof was completed.

[fire - consequence]

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.

6686 05 September 1994

Source : LLOYDS LIST, 1994, 9 SEP.

Location : North Sea, NORWAY

Injured : 0 Dead : 0

Abstract

Oil leaks reported from cracked crude oil pipeline.

[spill]

Lessons

[None Reported]

Source : THE SAFETY AND HEALTH PRACTITIONER, APRIL, 1997.

Location : Kent, UK

Injured : 7 Dead : 6

Abstract

A pedestrian walkway collapsed. The walkway had been installed four months prior to its collapse and was designed to be used by up to four million passengers a year. It led from a passenger terminal to a floating pontoon and from there to the ferry. The only part of the structure which was attached to the pontoon was the upper right hand foot which was attached by way of a stub axle and was thus a safety critical part of the design. The stub axle welds both failed as a result of fatigue cracking because the walkway and its foot assembly had not been designed to withstand the stresses to which it was exposed. Once these welds failed, the walkway section was unrestrained and simply walked off the support platform as a result of the pontoon's normal motion.

[metal fatigue, weld failure, fatality]

Lessons

[None Reported]

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

Location : Houston; Texas, USA

Injured : 0 **Dead** : 0

Abstract

Fire occurred when pump seal failed on coker unit. Substance involved heavy gas oil.

[fire - consequence, seal failure, processing]

Lessons

[None Reported]

6665 15 August 1994

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, OCT.; LLOYDS LIST, 1994, 18 AUG, & 24 AUG.

Location : Baton Rouge; Louisiana, USA

Injured : 4 **Dead** : 0

Abstract

Explosion on a marine transport barge of toluene led to a fire at the hall buck marine terminal. Lack of an earth on the flexible hose probably ignited flammable vapours during cleaning of the barge.

[lack of earthing, static, fire - consequence]

Lessons

[None Reported]

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

Location : Cheyene; Wyoming, USA

Injured : 0 **Dead** : 0

Abstract

A failure on a crude oil pump led to oil spray and fire.

[fire - consequence, pump failure, processing]

Lessons

[None Reported]

6658 08 August 1994

Source : LLOYDS LIST, 1994, 12 AUG., & 25 AUG.

Location : Balmoral Platform; North Sea, UK

Injured : 0 **Dead** : 0

Abstract

Spillage of 1.8 tonnes of crude oil seen on surface around offshore platform. Leakage identified as from rubber hose on seabed.
[hose failure]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, OCT.; LLOYDS LIST, 1994, 12 AUG.

Location : Mina Al Ahmadi, KUWAIT

Injured : 0 **Dead** : 0

Abstract

A leakage of gases caused fire in desulphurisation unit of refinery. Ignition reported as being due to a short circuit.
[refining]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A leak of 500 kg of (CS₂) from a flange in a pump house into a water filled containment sump over a period of time. Detector systems alarmed and the leak was contained. The area was hosed down following the leak and a pipe fitter stripped down the pipe upstream of a CS₂ metering station, once the system had been isolated. A 1 inch flange gasket was found to be in very poor condition and replaced. Production restarted but within a matter of hours a second meter station flange developed a similar leak. The system was cleaned down and all flanges in the metering station pipework had new gaskets installed as a precaution. Subsequent investigation showed that the meter station filters had been replaced 6 days before the incident, which involves replacing the gaskets. The correct gasket was specified for the duty. Further investigate showed that the suppliers supplied acid specification gaskets instead of acidit gaskets. These were of a lower specification not suitable for CS₂ duties. This fault was not picked up by the site prior to fitting.

[gasket failure, spill, installation inadequate, maintenance]

Lessons

Improvement required in goods inwards procedures to confirm that correct materials have been supplied as ordered.

Source : LLOYDS LIST, 1994, 25 JUL., 26 JUL., 27 JUL., 28 JUL., & 30 JUL.; THE GUARDIAN, 1994, 25 & 26 JUL.; OIL AND GAS JOURNAL; 1994, 1 AUG.; THE CHEMICAL ENGINEER, 1994, 11 AUG.; PROCESS ENGINEERING, 1994, OCT.; THE EXPLOSION AND FIRE AT THE TEXACO REFINERY..., HEALTH AND SAFETY EXECUTIVE, 1997, ISBN 0717614131.; LOSS PREVENTION BULLETIN, 138, 3-10.

Location : Milford Haven; Dyfed, UK

Injured : 26 **Dead :** 0

Abstract

On Sunday 24 July at 13:23 an explosion, followed by a number of fires, occurred at a cracking plant on a refinery. The series of the events that led to the explosion can be traced to a severe electrical storm prior to 9:00 am, which caused plant disturbances which affected the vacuum distillation, alkylation, and butamer units as well as the Fluid Catalytic Cracker Unit (FCCU). A fire resulted from a lightning strike in the crude distillation unit that provided feed to the cracking units. This unit was then shut down, with all but the FCCU being shut down during the remainder of the morning. However, the direct cause of the explosion that occurred some five hours later was a combination of failures in management, equipment and control systems during the plant upset. These led to the release of about 20 tonnes of flammable hydrocarbons from the outlet pipe of the flare knock-out drum of the FCCU. The explosion caused a major hydrocarbon fire at the flare drum outlet itself and a number of secondary fires. The company emergency response team and the county fire brigade effectively contained these fires and prevented escalation by cooling nearby vessels that contained flammable liquids. Fires were allowed to burn, under the supervision of the fire brigade, for over forty eight hours. This being the safest course of action as the flare relief system had been incapacitated by the explosion.

The incident was caused by flammable hydrocarbon liquid being continuously pumped into a process vessel that had its outlet closed. The only means of escape for this hydrocarbon once the vessel was full was through the pressure relief system and then to the flare line. The flare system was not designed to cope with this excursion from normal operation and failed at an outlet pipe. The outlet pipe was known to be corroded, however the investigation concluded that as the line was not designed for liquid transfer, and as such would most probably have failed regardless of condition. This released 20 tonnes of a mixture of hydrocarbon liquid and vapour which subsequently exploded.

The situation was caused by a combination of events, including:

1. a control valve being shut when the control system indicated it was open;
 - This was due to poor control room displays.
2. a which had been carried out without assessing all the consequences;
 - The knock-out drum was altered from pumping to slops automatically, to recycle and manual pumping to slops. This modification was carried out for environmental and efficiency reasons, and had the effect of altering an automatic plant protection system to a manual system.
3. control panel graphics that did not provide necessary process overviews;
 - Again due to poor control room displays, and poor alarm management.
4. attempts were made to keep the unit running when it should have been shut down.

[gas / vapour release, spill, management system inadequate]

Lessons

The official report makes 14 recommendations which are split into five headings:

Safety management systems

1. Safety management systems should include means of storing, retrieving and reviewing incident information from the history of similar plants.
2. Safety management systems should have a component that monitors their own effectiveness.

Human factors

3. Display systems should be configured to provide an overview of the condition of the process including, where appropriate, mass and volumetric balance summaries.
4. Operators should know how to carry out simple volumetric and mass balance checks whenever level or flow problems are experienced within a unit.
5. The training of staff should include:
 - (a) assessment of their knowledge and competence for their actual operational roles under high stress conditions;
 - (b) clear guidance on when to initiate controlled or emergency shutdowns, and how to manage unplanned events including working effectively under the stress of an incident.

Plant design

6. The use and configuration of alarms should be such that:
 - safety critical alarms, including those for flare systems, are distinguishable from other operational alarms; alarms are limited to the number that an operator can effectively monitor; and ultimate plant safety should not rely on operator response to a control system alarm.
7. Safety-critical plant elements on which the safety of a process relies, ie whose failure could lead to hazardous events, should be identified. Any safety system used to protect against hazardous events should be specified, and subsequently designed, based on an appropriate hazard and risk analysis so that the functions to be carried out and the necessary level of integrity are systematically determined.
8. In new build, or re-equipment, projects and in reviews of existing plant layouts, a risk assessment should be carried out with regard to the location, and suitability of construction, of buildings and plant.
9. In processes that employ a flare system, there should be effective arrangements for the removal of slops from a flare knock-out drum that ensure that the removal is promptly initiated and at an adequate rate to prevent overfilling the drum.

Plant modification

10. There should be a formal, controlled procedure for hazard identification and operability analysis for modifications (including emergency modifications) that ensures that all safety issues identified at the design stage are reflected in how the modification is constructed and used.

Inspection systems

11. All safety critical parts of plant should be included by companies in comprehensive inspection programmes.
12. Inspection programmes for corrosion should err on the side of caution, with regard to the number and location of measurement sample points, concentrating on measurement sample points where greater (or less uniform) metal loss is foreseeable.
13. All foreseeable operational conditions, not just pressure, should be taken into account when setting the minimum acceptable thickness for pipe and vessel walls.

Emergency planning

14. Fire brigades, in consultation with appropriate major hazard installations, would be wise to look at emergency plans particularly in respect of the availability of adequate water supplies for fire-fighting and vessel cooling, to deal with the worst case scenario.

6634 16 July 1994

Source : OIL AND GAS JOURNAL, 1994, 25 JUL.

Location : Cinizia; Gallup; New Mexico, USA

Injured : 2 **Dead** : 0

Abstract

Pressure vessel used to treat propane failed in an alkylation unit.

[vessel failure, rupture, gas / vapour release, processing]

Lessons

[None Reported]

Source : OIL AND GAS JOURNAL, 1995, JUL, 10.

Location : Komi, RUSSIA

Injured : 0 **Dead** : 0

Abstract

Transportation. Persistent leaks in the 32 mile pipeline of crude oil into the creeks and rivers has been aggravated by rains. About 580,000 bbl of oil has been spilt. The failure of the 20 year old pipeline was likely caused by poor foundations, inadequate pressure control, substandard water crossings and progressive internal corrosion.

[pipeline failure, pollution]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Fouling in vacuum distillation unit at a refinery. Excessive build-up of fouling material in the top pumparound circuit forced an unscheduled shutdown. Fouling was found in the top pumparound circuit.

The most likely cause of this incident involved a series of circumstances leading to the processing of a feedstock containing unsaturated gas oils, more susceptible to coking and slowly cracked over time by a combination of air ingress and localised temperature excursions.

[thermal degradation, stress corrosion cracking, refining]

Lessons

Assuming that feedstock purchase decisions cannot be radically altered then some degree of fouling is inevitable.

Source : ICHEME

Location : ,

Injured : 0 Dead : 1

Abstract

Electrical power supply failure and near miss at a refinery.

While replacing a fuse in the administration/laboratory building, an electrician caused a short circuit on a live system. There was power loss to the building and interruptions to lab operations. It was found that the relevant code and company procedures were not followed, and the switchgear was not isolated. The cause was lack of procedure and non-compliance even though it was established that the electrician had both adequate knowledge and adequate skill to complete the task.

[design or procedure error, refining, fatality]

Lessons

Even with well trained craftsmen, job task observation on a regular basis is essential to ensure that bad practices do not creep in.

Shortcuts in carrying out work on electrical equipment must not be tolerated; electrical isolation procedures must be followed, and it is essential to include all site buildings within the scope of the site permit/electrical work authorisation system.

6612 30 June 1994

Source : LLOYDS LIST, 1994, 2 JUL.

Location : Bandar Khomeini, IRAN

Injured : 26 **Dead** : 30

Abstract

20000 tonnes of wheat destroyed in silo explosion due to an electrical short circuit. Fatality.

[silo/hopper, storage]

Lessons

[None Reported]

6609 28 June 1994

Source : LLOYDS LIST, 1994, 30 JUN.

Location : Fort Wayne; Indiana, USA

Injured : 15 **Dead** : 0

Abstract

An explosion occurred in a soya bean processing factory when a spark ignited hexane gas.

Lessons

[None Reported]

6567 27 May 1994

Source : LLOYDS LIST, 1994, 30 MAY., 3 JUN., 17 JUN., & 2 DEC.; EUROPEAN CHEMICAL NEWS, 1994, 6 JUN.; CHEMICAL WEEK, 1994, 1 JUN, 22 JUN, & 29 JUN.; CHEMISTRY IN BRITAIN, 1995, FEB.

Location : Belpre; Ohio, USA

Injured : 0 **Dead** : 3

Abstract

Explosion and fire in a styrene butadiene block polymers resins plant near 3 tanks containing up to 5000 tonnes of styrene. Some people evacuated. Fire lasted for 10 hours. Plant remained closed. 316 tonnes of styrene, 127 tonnes of cyclohexane and 12 tonnes of ethylene dibromide released. It is suspected that there was a disproportionate amount of butadiene in the reactor where it was added to other chemicals. This may have started a reaction which caused a pressure build up in the reactor leading to vessel failure and explosion. Company agreed to pay \$3.02 m (1994). Fatality.

[high pressure, chemicals added incorrectly, unwanted chemical reaction, reaction vessel]

Lessons

[None Reported]

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 2ND QUARTER, 1994.

Location : Ferndale; Washington, USA

Injured : 0 **Dead** : 0

Abstract

Fire occurred when a pump seal failed on a catalytic cracker and was rapidly extinguished. Crude unit also shut down.

[seal failure, fire - consequence, cracking]

Lessons

[None Reported]

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 2ND QUARTER, 1994.

Location : Kaohsiung, TAIWAN

Injured : 0 **Dead** : 0

Abstract

Fire on a cracker in a furnace and was put out in 5 minutes. Caused thought to be due to cracked furnace tube. Substance involved naphtha.
[tube failure, fire - consequence, cracking]

Lessons

[None Reported]

6538 07 May 1994

Source : LLOYDS LIST, 1994, 9 MAY.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, JUL.

Location : Belayarsk, RUSSIA

Injured : 0 **Dead** : 0

Abstract

Fire at nuclear power plant leaked non-radioactive sodium into the atmosphere when a safety relief valve malfunctioned during maintenance.
[fire - consequence, valve failure]

Lessons

[None Reported]

6533 04 May 1994

Source : EUROPEAN CHEMICAL NEWS, 1994, 16 MAY.

Location : Frankfurt, GERMANY

Injured : 15 Dead : 0

Abstract

Fire broke out when flying sparks from a welding torch ignited a small vat of dichloronitrobenzene.

[fire - consequence]

Lessons

[None Reported]

6528 01 May 1994

Source : LLOYDS LIST, 1994, 5 MAY.

Location : Cristobal, PANAMA

Injured : 0 **Dead** : 0

Abstract

During the unloading of fuel oil from a marine tanker a spill of 1400 barrels occurred due to a valve failure. A further 400 barrels were spilt when the flexible hose failed.

[hose failure]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A leak occurred at the base of a debutaniser into the skirt of the column and subsequently overflowed into the plant sump. The leak resulted in the loss of 4.5 tonnes of polymer and approximately 2.5 kg of raffinate. The plant was immediately shutdown and the butane content of the column was pumped to storage. The factory fire service was called, but was not needed. There were no injuries, but the plant was shut down for 8 days. Although attempts were made to recover the polymer from the sump, some was found in the effluent outlet, such that the consent limit of 30 ppm oil would have been exceeded. The investigation into the incident showed that:

1. The site of the leak was a corroded 2 inch NB nozzle at the base of the column. The nozzle was a dead leg with no flow.
2. The corrosion was probably the result of condensate lying in the nozzle for 3-4 month periods between plant wash out.
3. Severe thinning had occurred at the interface between the polymer and the condensate.
4. A failure had occurred on a dead leg nozzle on a reboiler recirculation pump some months earlier. However, this nozzle had not been recognised as being vulnerable to the same type of failure.

[normal operations, plant shutdown]

Lessons

In addition to various repairs, inspections and stress calculations on the column, the following actions were taken:

1. The corrosion mechanism was to be investigated by the Company Metallurgist.
 2. The Plant Wash operating instructions were to be updated to cover the draining of dead legs to show they are free of condensate.
 3. When a scheme of examination is set up for a plant item, previous inspection reports should first be reviewed.
 4. The drainage route for the plant effluent should be reviewed.
 5. Some alterations to the Emergency Response Procedures were recommended for further consideration.
-

6498 08 April 1994

Source : LLOYDS LIST, 1994, 9 APR., & 11 APR.

Location : Zaanstad; Amsterdam, NETHERLANDS

Injured : 5 **Dead** : 1

Abstract

Explosion at chemical packaging plant. A barrel containing chemicals toppled over and was set on fire by sparks from a forklift truck. The blaze spread to tanks containing propane and butane. Fatality.

[fire - consequence, processing]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A fire occurred on crude distillation unit at a refinery. During start-up of the crude distillation unit, a release of hydrocarbon vapour from the main fractionator column ignited. It was found that thermal stress had led to relaxation of flange bolts and a subsequent release of hydrocarbon. As changes during shutdown and start-up of the unit occurred, inspection and maintenance activities did not increase.

[maintenance inadequate, refining, gas / vapour release, fire - consequence]

Lessons

Operator routine walks through plants should include checking for flange leaks, especially during condition changes, and also during dramatic weather condition changes; e.g., heavy rain may provide thermal stress on hot flanges sufficient to cause relaxation.

6479 24 March 1994

Source : THE CHEMICAL ENGINEER, 1994, 31 MAR.; EVENING MAIL, 1994, 25 MAR.

Location : Durham Woods; Edison; New Jersey, USA

Injured : 50 Dead : 1

Abstract

Explosion of an underground natural gas pipeline caused massive flames which were seen 50 miles away. Pipeline installed at a depth of 2.5 metres and now found to have 5-7 metres of earth covering it. 50 m crater left. An investigation revealed that the pipeline had been gouged by excavation damage. The mechanically induced gouge probably produced a crack that grew to critical size most likely as a result of metal fatigue.

Fatality.

[fire - consequence]

Lessons

Install retrospectively automatic or remotely operated isolation valves where high pressure pipelines enter and leave urban areas.

Aerial surveillance procedure inadequate as it did not require the identification of excavation activities within industrial locations.

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

An electrical fault in a substation resulted in a complete power failure to the plant, and some collateral damage to a starter column as a result of arcing. The resultant power loss also affected an adjacent research department, causing the shut down of two pilot plants. All affected plants failed to a safe condition following loss of power.

Investigation of the incident found that there had been ingress of rainwater into the electrical equipment in the starter column 1. leading to arcing between the busbar droppers, which then developed a three phase to earth fault. The ingress of water was due to a defective substation roof (reported to have been caused 'by normal wear and tear').

[electrical equipment failure, power supply failure, plant shutdown, electrical]

Lessons

[None Reported]

6475 21 March 1994

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

Location : Minas Oilfield, INDONESIA

Injured : 31 **Dead** : 1

Abstract

A 12 inch natural gas pipeline failed injuring passengers in a passing bus. Cause of pipeline failure was unclear.
[fatality, injury]

Lessons

[None Reported]

6472 18 March 1994

Source : PETROLEUM REFINER, 1995, FEB.

Location : Piper Bravo; North Sea, UK

Injured : 0 **Dead** : 0

Abstract

Two men were draining hydrocarbon from a sealpot using buckets. A fire began due to static in one bucket and spread to the mens clothing. The fire was extinguished quickly and neither were hurt. Neither of the buckets were bonded to earth. Company were fined £5000 (1994).
[fire - consequence, lack of earthing]

Lessons

[None Reported]

6465 16 March 1994

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

Location : Bashkortostan, RUSSIA

Injured : 0 **Dead** : 0

Abstract

Explosion within a gas compression station believed to be due to a pump failure.

[compressor, processing]

Lessons

[None Reported]

Source : LLOYDS LIST, 1994, 4 MAR.

Location : , ALASKA

Injured : 0 Dead : 0

Abstract

2000 to 2500 gallons of residual oil spilled at pump station. Crude oil overfilled holding storage tank when alarm switch failed.
[overflow, instrumentation failure]

Lessons

[None Reported]

Source : EUROPEAN CHEMICAL NEWS, 1995, 6, MAR, 12, MAR.

Location : Frankfurt, GERMANY

Injured : 2 **Dead** : 0

Abstract

Naphthol powder was being emptied from a metal container into a blender when the dust ignited. The stirrer was not working at the time. Electrostatic spark considered to be the ignition source.

[fire - consequence, dust explosion, charging reactor, naphthol]

Lessons

[None Reported]

6432 22 February 1994

Source : LLOYDS LIST, 1994, 23 FEB.

Location : Nanjing, CHINA

Injured : 0 Dead : 0

Abstract

1200 tonnes of waste oils and chemicals including sulphuric acid in corroding storage drums may be washed into river in rainy season.

[pollution, corrosion]

Lessons

[None Reported]

6406 01 February 1994

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

Location : Haifa, ISRAEL

Injured : 0 Dead : 0

Abstract

Major fire resulting from an electrical short circuit led to loss of one of ten production units.

[fire - consequence, processing]

Lessons

[None Reported]

Source : LLOYDS LIST, 1994, 3 FEB.; THE CHEMICAL ENGINEER, 1996, 25 JUL.; ENDS REPORT NO. 229, 1994, FEB.; HAZARDOUS CARGO BULLETIN, 1994, JUN., 76.; HEALTH & SAFETY BULLETIN, 1996, SEP., 9-12.

Location : Ellesmere Port; Liverpool, UK

Injured : 4 **Dead** : 0

Abstract

A leak of ethyl chloride occurred from a recirculating pump. The release of ethyl chloride solution, hydrogen chloride and catalyst - a toxic flammable corrosive mixture - found a source of ignition and a fire raged until well into the next morning. All non-essential workers were evacuated and neighbours warned. Roads closed. The suspected cause was either corrosion of a valve or a fault on the feeding the valve. The fast release of ethylene chloride suggests sudden failure of a joint assembly.

[maintenance inadequate, evacuation, joint failure, processing]

Lessons

The following actions were taken;

1. insulation cladding on the process vessels;
 2. relocation of the reactor to separate it and possible spillages from other plant;
 3. relocation and enlargement of a run-off lagoon;
 4. reduced vessel connections below liquid level, with shut-off valves;
 5. dedicated pumps, at the point of original failure, simplifying pipework;
 6. extended cladding, level indicators, and flammable gas detectors.
-

Source : THE GUARDIAN, 1994, 26 OCT.

Location : Komi Region; West Siberia, RUSSIA

Injured : 0 **Dead** : 0

Abstract

Transportation. A spill of 2 million barrels of oil occurred from a pipeline that suffered corrosion.

Lessons

[None Reported]

6392 25 January 1994

Source : LLOYDS LIST, 1994, 11 FEB.

Location : Whiting; Indiana, USA

Injured : 0 Dead : 0

Abstract

3 fires in the space of 17 hours knocked out production. Severe weather conditions caused freezing of pipes and subsequent cracking of pipes.
[weather effects, fire - consequence, processing]

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 : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Hydrocracker heat exchanger failure at a refinery.

Two occurrences of tube failures in an exchanger in the reactor effluent circuit each resulted in the hydrocracker being shut down. There was damage to equipment, and product loss. It was found that erosion, corrosion stress was brought on by velocities in the reactor effluent exchangers which were in excess of the licensor's recommendations.

The inadequate identification of both the corrosion risk to reactor effluent circuit exchangers and the appropriate mitigation strategy caused this incident.

[reactors and reaction equipment, refining, cracking]

Lessons

Management of Change (MOC) techniques could have improved the timeliness of identifying both the corrosion risk to the reactor effluent circuit exchangers and the appropriate strategy to mitigate.

124091994

Source : ICHEME

Location : ,

Injured : 2 Dead : 0

Abstract

A fire occurred on one of the charge pumps of the debutaniser section of a hydrocracker unit, resulting in severe damage to pumps, heat exchanger, air coolers, surrounding pipework, steel structure and the debutaniser column.

The cause of the fire was attributed to failure of the screwed drain connection of the pump casing.

Fortunately, there were no severe casualties, and only two minor injuries occurred during the fire-fighting operation. Repairs took six months to complete and cost approximately USD 7.5 million (1994).

The cause:

It was found that, in addition to the blown-out pump drain, some process lines had ruptured and a number of flanges had failed. However, since these lines and flanges showed no signs of significant corrosion, it was concluded that their failure was due to the heat of the fire.

[fire - consequence, damage to equipment, material of construction failure, flange failure, hot surface, injury]

Lessons

[None Reported]

124101994

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A potentially serious incident occurred recently on an offshore installation when 12 stud bolts on a production choke valve failed a short time after the well had been brought into production.

An investigation into the failures found that the most likely cause of the bolt failures is due to sulphide stress corrosion cracking. The combination of a high-applied stress and the presence of hydrogen sulphide generated by the hydrolysis of the molybdenum disulphide that was present in one of the greases used during valve assembly.

[bolt failure, near miss]

Lessons

[None Reported]

124211994

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Two incidents occurred with single deck pontoon roofs (with radial stiffeners) on 76 degree m dia. crude tanks and one with a single-deck pontoon roof on 36 m dia. platformate tank.

The latter single deck had sunk to the bottom and the full surface of the tank was covered with a foam blanket. However, during a severe storm with an electric discharge in the area the tank content caught fire. The fire was extinguished within an hour.

[storage tanks, floating roof failure, lightning, fire - consequence]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, MAR.; LLOYDS LIST, 1994, 14 JAN.

Location : Oxnard; California, USA

Injured : 0 **Dead** : 0

Abstract

An 8 inch underground pipeline ruptured, due to corrosion, causing a spill of 84000 gallons of crude oil.

Lessons

[None Reported]

6334 09 December 1993

Source : LLOYDS LIST, 1993, 10 DEC.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, JAN.

Location : English Channel, UK

Injured : 0 Dead : 0

Abstract

A marine transportation incident. A marine tanker sustained a ballast tank rupture and pump failure in a storm leading to a spill of xylene. Vessel overturned and sank.

[weather effects, sinking]

Lessons

[None Reported]

Source : ICHEME

Location : , USA

Injured : 0 Dead : 0

Abstract

Fire in lowest section of packed distillation column when column was open for repair following scheduled inspection. Plasma arc cutting equipment was in use when spark ignited deposit within packing. Substance involved: adiponitrile. Fire lasted 4 hours and did \$2 million (1993) damage.

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, FEB.; EUROPEAN CHEMICAL NEWS, 1993, 29 NOV.

Location : Beaumont; Texas, USA

Injured : 7 **Dead** : 0

Abstract

Explosion at butadiene derivatives complex. Explosion caused by a breakdown in a compressor unit that cracked its housing leading to a leak of propane which was used as a coolant at the facility.

[processing]

Lessons

[None Reported]

6310 21 November 1993

Source : THE CHEMICAL ENGINEER, 1993, 25 NOV.

Location : Haifa, ISRAEL

Injured : 0 Dead : 0

Abstract

Three gas leaks in pipeline serving a chemical complex from a refinery. Poor maintenance and corrosion were blamed for this incident.
[maintenance inadequate, gas / vapour release]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A leak in a product transfer line from a refinery to another company resulted in a spillage of just over 600 bbls. of low sulfur diesel oil. The leak was caused by a gasket failure on a flange in a valve pit at a location on this underground line which offtakes to another company.

The leak occurred outside the refinery property. Oil overflowed the valve pit and resulted in contamination over an area of about 3,500 feet. Pick up of oil and preliminary clean-up was promptly started the same day. Oil entered a drainage ditch but did not reach the nearby river.

Total costs so far are estimated at some \$74,000 (1993). There were no injuries sustained in the incident.

The cause of the release was failure of a gasket on the portion of the line that connected to the company.

The portion of the line running to the marine dock had been pressure tested in 1991, with the gasket being replaced at that time.

The difficulty experienced in putting the valve back in position after replacing the gasket suggests the possibility that the gasket had been pinched in 1991.

Another possible cause for the failure of the gasket is that the company portion of the pipeline moved due to frost heave, etc. putting additional stress on the gasket.

[material transfer, weather effects]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Transportation. Diesel oil spill at a refinery. A spill of low sulphur diesel oil was discovered off-site while product was being transferred via a pipeline. Gasket failure on the pipeline and possible improper installation of the gasket were immediate causes of this incident. The basic cause was insufficient inspection activities as service life of gasket extended.

Product loss, clean-up cost of gross contamination, soil disposal, investigation for an estimated \$75,000 (1993).

[material transfer, installation inadequate]

Lessons

Where the integrity of off-site operations cannot be monitored, the value of quick, effective emergency response cannot be understated.

6253 06 October 1993

Source : EUROPEAN CHEMICAL NEWS, 1993, 11 OCT. & 18 OCT.; THE CHEMICAL ENGINEER, 1993, 14 OCT.; CHEMICAL WEEK, 1993, 13 OCT.

Location : Frankfurt, GERMANY

Injured : 13 **Dead** : 0

Abstract

Cloud of chlorine escaped from chloralkali electrolysis plant. The suspected cause was corrosion in a cooling system. The plant was shutdown.

[gas / vapour release, cooling equipment, processing]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 117, 17.

Location : Georgia, USA

Injured : 1 Dead : 0

Abstract

Workers were transferring a 93% solution of sulphuric acid from a 3785 litre storage tank to 378 litre "day tank" when a 2.5 cm carbon steel transfer pipe line failed. The failure caused sulphuric acid to be sprayed about 18 metres from the origin of the leak. A worker walking through the area was sprayed by the acid mist and received second degree burns on his back. After being washed down in a safety shower by fellow workers, he was taken to a medical facility for treatment. The procedure for transferring acid from the bulk tank to the day tank required that the valve at the dilute tank be closed and that a transfer pump be used to facilitate the transfer of acid from the bulk tank to the day tank. When the accident occurred, the valve at the dilute tank was closed and the transfer pump had been started. The pump built up pressure in the pipe, causing the mist of acid.

An inspection indicated that the failed line was constructed of carbon steel and appeared to be a "Schedule 40 pipe", although the engineering drawings specified use of "Schedule 160 pipe", which has walls approximately twice as thick. In addition, it was known that the flow of acid through the line normally reduces the thickness of the pipe wall by about 5 microns per year. The section of the line that failed had been replaced approximately 10 years ago. On this occasion, as soon as the leak was discovered and the transfer pump shut down, the area was barricaded and thoroughly washed. All piping was subsequently inspected using non-destructive evaluation (NDE) techniques, and pipes of insufficient thickness were replaced.

[pipeline failure, incorrect equipment installed, spill, material transfer]

Lessons

This incident provided several lessons relating to configuration control and the handling of corrosive materials:

1. Whenever system components are replaced or repaired, engineering documents must be checked to ensure that the correct materials are used. Engineering documents (especially drawings) must be carefully managed to ensure that they are kept up-to date. However, specifying the correct materials and components for maintenance and repairs is not enough. Follow up must be conducted to ensure that the entire process is performed correctly, appropriate replacement items must be ordered, inspected on receipt, adequately documented in work orders, installed, and functionally tested.
2. Management must ensure that all hazardous materials and processes are identified and that procedures are developed and implemented to ensure safety. A preventative maintenance programme, including a replacement schedule or through NDE testing, should be established to replace components where failure would result in serious safety or environmental consequences.
3. Implementation of relevant standards related to mechanical integrity, procedures, and training should have prevented the use of incorrect schedule piping. Although many standards apply to facilities with quantities of hazardous material above a certain thresholds, these recommended practices will prevent accidents even when applied to facilities that are not covered by the standard.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Spent acid failure. The alkylation unit's spent acid tank overpressurised, causing the roof and shell to separate completely from the floor, the reaction force propelled the tank into an adjacent tank. Hydrocarbons were released, and a fire ensued. There was equipment damage. It was found that weakly alkaline water was pumped into the spent acid tank, and the dilution of spent sulphuric acid in water released heat, increasing the temperature of the hydrocarbon layer, resulting in the tank overpressurising. The basic cause was insufficient monitoring to prevent weakly alkaline water from entering spent acid tanks.

[overpressurisation, spill, fire - consequence, damage to equipment, design or procedure error]

Lessons

When transferring liquids in a system containing acids and water solutions, account must be taken of the heat of dilution released by the chemical reaction of mixing acids with water or alkaline water mixtures. As was demonstrated, this can be sufficient to initiate equipment damage.

Source : LLOYDS LIST, 1993, 29 SEP.

Location : Cairo, EGYPT

Injured : 0 **Dead** : 0

Abstract

Pipeline burst and fuel oil formed 2 lakes which ignited. Cause attributed to corrosion.

[fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Reformer reactor flange fire at a refinery. During start-up of the reactor, after a small fire on the inlet flange, yet another fire broke out, this time on the bottom flange of the same reactor. It was found that the flange bolts were not secure. The basic cause was the absence of procedure for torque wrench tightening of bolts on reactor vertical flanges and inadequate inspection of flanges.
[fire - consequence, reactors and reaction equipment, refining, bolts incorrectly tightened, inspection inadequate]

Lessons

Flange bolt tightening techniques need to be correctly done, appropriate to the temperature range of the system from start-up to operating conditions.
Flange bolting can be loosened during heavy rainfall; e.g., flanges or fittings with the shanks of bolts exposed can be particularly vulnerable.

6206 27 August 1993

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

Location : Melbourne, AUSTRALIA

Injured : 0 Dead : 0

Abstract

A marine transportation incident. Valve failure on marine tanker caused spillage of 2000 litres of crude oil at discharge jetty.

Lessons

[None Reported]

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

Location : Near Valleyview; Alberta, CANADA

Injured : 0 **Dead** : 0

Abstract

Transportation. 36 inch natural gas pipeline failure led to a fire that burnt forest.

[fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Packing Gland Fire. Due to the extensive damage on the heater, the valve normally used for up-stream isolation of the fuel gas control valve was inaccessible, so a valve located some 15ft away in an overhead piperack was used for the isolation.

Work to repair the heater required use of burning torches. Area gas tests were carried out before the issue of a hot work permit and a fire watch was required at the work site. However, because of its location in the piperack, with its difficult accessibility, gas tests were not done around the isolating valve.

During the overhead demolition, sparks fell to the ground around the base of the heater and onto the isolation valve igniting gas leaking from its packing gland.

Fire water was applied to the packing gland, but the fire would not go out.

Two operators climbed out into the piperack from the heater deck while other personnel applied fire water to the area. However, they could not close the valve any tighter and were told to leave the piperack by Safety Department personnel. A maintenance supervisor climbed out to the valve and pulled up the bolts on the packing gland, and this finally extinguished the fire. He also tightened up the bolts on the blind flange, which were presumably loose from the fire.

There were no injuries sustained in this incident.

[fire - consequence, damage to equipment]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Flange Gasket Failure. A section of flange gasket in the same isolation valve failed.

Hot work had been stopped because of the previous incident with the packing gland of the valve. About one hour later, there was a request for re-issue of the hot work permit, and discussion was held about the safety of the job site. The unit operator detected a strong smell of fuel gas in the work area and requested a waiting period for the gas to dissipate.

Following further discussion, gas testing at the blind flange of the valve indicated a leak. Maintenance personnel loosened two bolts on the flange to replace the gasket, and suddenly a section of the gasket blew out releasing fuel gas at 50 psig.

Fire water streams from hoses and monitors were applied to inhibit any possible ignition. Since the isolation valve could not be closed any further, the fuel gas header from the fuel gas knock-out pot had to be depressured, which necessitated shut down of crude unit. The incident passed without injury to personnel.

[gas / vapour release, near miss]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A major bus fault occurred on a refinery in a Motor Control Center (MCC). The short circuit completely destroyed the MCC and created a fire in the cable tray in an area of a large concentration of wiring connected to this and the adjacent MCC. There were no injuries to personnel, estimated cost of temporary and permanent repairs was \$150,000 (1993).
[damage to equipment, electrical]

Lessons

The reporte stated the following recommendations:

1. A balance needs to be achieved between the level of protection provided to protect components of an electrical system and yet maintain continuity of the system as a whole, with as far as possible avoiding wider ranging power outages.
 2. Silver plated bus bars should be routinely inspected to en-sure that there are no signs of excessive flaking from the bars.
-

6174 02 August 1993

Source : LLOYDS LIST, 1993, 4 AUG., & 27 SEP.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, SEP.; THE SUN BALTIMORE, 1993, 3 AUG.

Location : Baton Rouge; Louisiana, USA

Injured : 1 **Dead** : 3

Abstract

Explosion and fire in coker unit in refinery where heavy, tar-like oil is processed into gasoline. Cause found to be due to rogue valve, carbon steel instead of alloy, in the refinery. Fatality.

[incorrect equipment installed, refining]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A platformer unit fire at a refinery. A fire occurred on a platformer reactor stack, and it burned for 5 hours. There was damage to equipment. It was found that a vertical section of feed inlet line to the No. 2 reactor failed. The failed section of line was noticeably out-of-round, which would have led to increased stresses. Costs estimated to be \$1.5 million (1993) for maintenance/other and \$6.2 million (1993) for production losses.
[fire - consequence, reactors and reaction equipment, refining]

Lessons

1. To prevent future failure of these and other high temperature piping systems, companies must be critical of fabrication qualification and selection.
 2. On emergency response fire water delivery capabilities for elevations greater than 100 feet should be reviewed. Fire water systems are susceptible to host biological organisms which can plug or impede delivery equipment and tests should be made regularly, especially in warm climates.
-

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Crude distillation unit heater explosion in a refinery. During attempt to re-light crude furnace, following an emergency shut-down due to instrument air failure, an explosion occurred. Contributing to the incident was the urgency to re-light the furnace to prevent shutdown of the FCC (Fluid Catalytic Cracker) unit and related equipment. The cause was failure to follow safe-out and start-up procedures on the fired heater. There was damage to equipment and the total cost was estimated at \$8 million (1993).

[instrumentation failure, human causes]

Lessons

Supervisors should increase the awareness of all personnel, particularly operators, to the potential for explosions during non-routine situations such as hot and cold heater light-offs. Personnel need to develop a healthy respect of situations and to proceed with caution. Done correctly, such operations pose minimal dangers. Done incorrectly, these operations can prove to be hazardous to personnel as well as destructive to equipment.

6160 26 July 1993

Source : LLOYDS LIST, 1994, 21 FEB.

Location : Richmond; California, USA

Injured : 0 **Dead** : 0

Abstract

A rail tanker safety seal failed when unloading 45000 litres of oleum. White cloud formed. The highway and ship channel were closed and led to the evacuation of 2000 people.

[seal failure, sulphuric acid]

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]

6150 13 July 1993

Source : CHEMICAL HAZARDS IN INDUSTRY, 1993, SEP.

Location : Miaoli, TAIWAN

Injured : 3 **Dead** : 4

Abstract

Sparks during maintenance ignited vapours in a polyvinyl chloride (PVC) storage tank undergoing repairs. Fatality.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

DHT compressor explosion and fire at a refinery. An explosion and fire occurred at a reciprocating recycle H₂ (hydrogen) compressor during commissioning of a new DHT Unit. It happened during the reactor presulphiding step, when the recycle gas contained 9000 ppm of H₂S (hydrogen sulphide) and the pressure was at 940 psig. Failure of retaining bolts on head-end suction valve unloader of recycle cylinder on compressor allowed release of process gas.

Investigations revealed that the bolts failed due to inappropriate material (to prevent sulphide stress cracking) and inadequate design for the service. The manufacturer did not comply with the company's practice for reciprocating compressors in H₂S applications.

Estimated at \$100,000 (1993). Damage to compressor shelter, instrumentation. Estimated 250 manhours spent on investigation.

[fire - consequence, damage to equipment, design inadequate, refining, incorrect material of construction, stress corrosion cracking]

Lessons

Standards in design control, purchasing, construction, and inspection and testing of purchased equipment, are essential to the safety of any process plant project.

Each group involved in a project, whether projects, contractors, suppliers, designers, procurement, manufacture, construction, etc. plays a key role in assuring the equipment's fitness for use.

All possible process conditions must be detailed in the specification for the purchase of equipment.

HAZOP studies must include all deviations from the design operating conditions such as shutdown, start-up, maintenance, and other activities such as the presulphiding process to check the adequacy of the design.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

High temperature corrosion in piping dead legs. After start-up of a crude distillation unit, smoke was seen coming from an uninsulated flange. It was found that a valve had failed due to internal corrosion. The basic cause was inadequate monitoring of dead legs, and the removal of unnecessary dead legs from service.

[valve failure, maintenance inadequate]

Lessons

The existence of process piping dead legs presents hazards which must be recognized and addressed.

Source : LOSS PREVENTION BULLETIN, 117, 24.

Location : ,

Injured : 0 Dead : 0

Abstract

A valve between the reactor top and the charge line of the diamine and nitrogen, prone to the occasional slight leakage, had been replaced with new ball valve.

There was slight difference between the flange on the reactor and the new valve that required the bolt holes in the valve to be elongated outwards to enable a good alignment and fit. A slip ring gasket was therefore fitted between the faces. On the day of the incident the reactor was charged then sealed and pressure tested in the cold with nitrogen to 2.4 bar g and held for 10 minutes. After complying with the pressure check, the reactor was vented down then resealed ready for its reaction. After 5 hours of its reaction the gasket partially blew out releasing some diamine/methanol mixture in vapour form. An operator passed through some of the cloud making his escape and was effected by inhalation of the fumes.

The most probable cause of the incident was the misalignment, by 6mm, of the gasket on the reactor flange. This misalignment would probably not be noticed at the fitting because of the "play" created by the different bolt centres.

[gas / vapour release, equipment misalignment, maintenance, toxic fumes]

Lessons

The following recommendations were made:

1. Where a new piece of equipment has differing fittings to that being replaced the management of change systems must be invoked. This will properly consider what action needs to be taken. The expedient of slotting bolt holes to make a fit is fraught with potential hazards and should be avoided. When different standards are to be connected, a spool piece making the conversion should be used normally. Full face joints should be used as in application these are self aligning. Slip ring gaskets should not be used in safety critical joints unless they are expressly specified such as spiral wound gaskets.
 2. It must be re-emphasised to all maintenance personnel that a change in standards, all be it an updating, is a change and is subject to the modifications and change control procedure.
 3. Where an emergency condition can release toxic fumes, the reactor should be fitted with remotely operated shut down facilities.
-

6076 20 May 1993

Source : THE CHEMICAL ENGINEER, 1993, 16 SEP.; CHEMICAL HAZARDS IN INDUSTRY, 1994, APR.

Location : Institute; Charleston; West Virginia, USA

Injured : 17 **Dead** : 0

Abstract

Hose burst releasing 10 gallons chlorine at barge loading terminal.

[hose failure, gas / vapour release]

Lessons

[None Reported]

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

Abstract

An explosion and fire occurred on a reciprocating recycle hydrogen compressor.

Compressor commissioning began on 5 May, 1993. The compressors were first run-in with valves removed and then with the valves installed. The first run-in was under nitrogen pressure, and lasted for 4 hours for both compressors on the unit.

The valves were then installed and the high pressure system was brought up to 100 psig with nitrogen and the compressors started. This test lasted for 5 hours with discharge pressures being raised to 500 psig, and then the compressors were shutdown.

The compressors were next started on 7 June, running on nitrogen, for the unit dryout period. After this was done, the compressors were shutdown, the unit depressured, and repressured with hydrogen in preparation for injection.

The compressors were restarted on 12 June, and injection commenced at 15.00 hours on 13 June, with both compressors on line. Compressor operations were stable. The only abnormality noted by the operators before the incident was that when pressuring-up the system slowly with the compressors running, the frame vibration alarm was coming in on one of the compressors.

This alarm is set at 0.15 ips, with vibrations going up to 0.17 ips. Also, the nitrogen purge alarms had been in since the compressor was started. This nitrogen purge is designed to purge the compressor distance pieces and piston shaft packing.

At 02.30 hours on 14 June, a low cylinder lube oil level alarm came in on a compressor; oil was added and the alarm went out. No other alarms came in until the explosion at 04.40 hours.

When the incident occurred, the first phase of presulphiding had been completed. The reactor temperature was 525 degrees F, injection had been discontinued, and the hydrogen sulphide concentration in the recycle gas had stabilised at 9,000 ppm. The unit pressure decreased during the period of hydrogen sulphide stabilising, from 940 to 840 psig by reducing the gas make-up rate.

The reactor inlet temperature was being raised from 525 degrees F to the target of 650 degrees F, when at 535 degrees F the incident occurred.

Investigations were carried out and the following was found:

The initial investigation concluded that the incident was caused by failure of the retaining bolts on the head-end suction valve unloader of the recycle cylinder on the compressor. The unloader blew off the compressor, releasing process gas. Ignition was instantaneous, probably caused by a spark as the unloader hit the pulsation damper, or by spontaneous ignition of hydrogen.

Independent analysis of the bolts concluded that failure in the south and west studs was consistent with hydrogen degradation. The failure in the north and east studs was consistent with mechanical overload. The high hardness of the alloy studs increased susceptibility to hydrogen damage and is a likely factor in the failure.

[fire - consequence, testing, reactors and reaction equipment, damage to equipment, corrosion]

Lessons

[None Reported]

6044 21 April 1993

Source : LLOYDS LIST, 1993, 23 APR.

Location : Rotterdam, NETHERLANDS

Injured : 0 **Dead** : 0

Abstract

Fire broke out in desulphurising installation at refinery. One feed pump became defective and oil leaked out and ignited.

[fire - consequence, pump failure, refining, separation]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

High pressure steam at 600 psig is generated in two supplementary fired CO boilers at the refinery.

Combustion air to each boiler is supplied by individual (non-spared) forced draft fans.

After a period of observation, starting with noisy running, the outboard bearing of the forced draught fan of one of the boilers became sufficiently hot to enforce a controlled steam load shedding and shutdown of the boiler. It was subsequently found that a build up of sludge de-positis in the bearing housing of the fan had prevented adequate lubrication to the outboard bearing, causing the bearing to fail.

Total losses from the forced shutdown were \$161,000 - \$95,000 (1993) in unit throughput adjustments, \$56,000 (1993) benzene to gasoline adjustments, and \$10,000 (1993) repair costs to the fan bearings. One air violation was incurred as the result of having to vent CO.

Although there were no injuries sustained and no fire damage, it is considered that there was a significant potential for fire and equipment damage.

[lubrication failure, bearing failure, plant shutdown]

Lessons

The report stated the following recommendations:

1. It is essential that high integrity and well maintained lubrication systems are used for equipment, which can be proved in service to be effective, and flushed out as necessary.
 2. Quantities of lubricant used to be monitored to detect changes up or down, either of which can indicate potential problems. Qualities of lubricants supplied should be the subject of routine proof testing.
 3. For some equipment - e.g., such as large electric motors with a constant volume lubricant system - at major overhauls labyrinths/oilways to be inspected/cleaned.
 4. Other monitoring systems, such as bearing temperatures and vibration, routine checks on oil quality of samples taken from the lubrication system, is necessary especially if it is critical equipment without a standby.
-

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Boiler fan bearing failure at a refinery. Investigation of noisy forced draft fan resulted in monitoring and, thereafter, shutdown of boiler to examine the bearing housing. It was discovered that a considerable amount of sludge had built up in the bearing housing. The immediate cause was sludge forming mechanism that prevented adequate lubrication to the forced draft fan outboard bearing, causing the bearing to fail. Contributing to the incident was oil line to the oiler and other the other level indicator had been plugged with sludge and resulted in false oil level readings. The basic cause was that there was not an adequate means of checking the oil in the housing, therefore, the sludge build-up went undetected. The forced draft fan was a critical piece of equipment, and it was not possible to take it out of service to check the bearing housing without a shut-down.

Losses, unit throughput adjustments, \$95,000 (1993), product adjustments, \$56,000 (1993), maintenance, labour, and materials, \$10,000 (1993), environmental violation.

[refining]

Lessons

1. When there is no redundancy (spare equipment) built into the process, it is essential that high integrity and well maintained lubricating systems are installed.
 2. Quantities of lubricant used should be monitored to detect changes up or down, either of which can indicate potential problems.
 3. Qualities of lubricants supplied should be the subject of routine proof testing.
-

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

The roof of a tank which was located in an Effluent Treatment Plant lifted off the tank and flew some 175 feet south. The roof knocked over an area lighting pole, severed some power lines, bounced on the ground, and eventually came to rest near a railway track. The gauger's platform was also separated from the tank and travelled some 100 feet east, landing near a filter house.

Witnesses in the area reported hearing an explosion, seeing flames coming from the tank, and seeing subsequent arcing coming from the power transmission lines. Witnesses reported that the flames were present only during the initial flash and that smoke dissipated after a short time. Witnesses also reported hearing a turbine-like roar which lasted several seconds or more immediately preceding the incident.

After the explosion, the tank wall and floor remained intact. No leakage of the tank contents after the event were noted. There were no injuries.

It has been determined that the roof on the tank failed due to the ignition of a flammable mixture in the vapour space of the tank. While numerous sources could potentially create a flammable vapour space in the tank, the most probable source was normal variations in the volatility of the Dissolved Air Flotation (DAF) float combined with changes in sealing and scrubbing of the DAF units required by environmental regulations.

Evidence points to overheating of the carbon drum on the tank vent as the source of ignition.

[explosion / pressure release, mechanical equipment failure, gas / vapour release]

Lessons

[None Reported]

6004 28 March 1993

Source : OIL AND GAS JOURNAL, 1993, MAR.; LLOYDS LIST, 1993, 9 APR.

Location : Virginia, USA

Injured : 0 Dead : 0

Abstract

9708 barrels of fuel oil spill from pipeline threatened water supply to town. Rupture caused by fatigue crack initiated by mechanical damage from heavy construction equipment. The rupture was 52 inch long and 5 inch wide.
[damage by backhoe]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A minor tube leak was discovered in the bank of tubes of a 2nd Stage Effluent Air Cooler. Shortly after, as preparations were made to depressure the unit, the leaking carbon steel tube in the bottom row bank burst. The unit was quickly depressured and shut-down.

The tube failed as a result of general and localised corrosion at the outlet end on the bottom row adjacent to the tube-to-tubesheet weld behind the outlet header. Average remaining wall thickness in the vicinity of the failure is estimated to have been sufficient to contain pressure, but localised corrosion reduced effective thickness and provided a high stress concentration which contributed to a ductile overload failure.

[operational activities, rupture, mechanical equipment failure, piping & fittings]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Isocracker air cooler failure at a refinery. Shortly after discovering a minor tube leak in a tube of an air cooled heat exchanger bundle on the isocracker, the tube ruptured. The tube failed due to acid corrosion.

Due to the collapse of the trays in the Recycle Splitter 12 months previous, the bottoms temperature of the first-stage stripper was lowered by 15-25 degrees F (8-14 degrees C) from its normal operating temperature. This "subtle" change caused an increased water content in the stripper bottoms and, as a consequence, normally dry conditions in the second stage air cooler became wet and accelerated ammonium chloride corrosion.

Losses total of \$1.6 million (1993), \$1.1 million (1993) in lost opportunity and \$0.5 million (1993) in maintenance and repairs.

[cooling equipment, tube failure, damage to equipment, cracking]

Lessons

Beware of small changes in operating conditions/modifications to plant, small changes in feedstock composition, etc. can produce accelerated corrosion conditions which may occur between inspection periods.

Regular removal of deposits from air cooled heat exchanger bundles/header boxes is recommended. Ensure any water flushing is done with chloride free water, and the bundle thoroughly air dried before return to service.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A refinery suffered a serious near miss incident when with-drawing a corrosion probe from a 14 inch live piping system on a Crude Distillation Unit. Unknown to the inspection engineers, the outer probe holder had suffered stress corrosion in service and had broken completely about 14 inch from the tip during the withdrawal operation.

There was a significant release of light hydrocarbon gases through the annular space between the probe holder and the probe when the broken part of the holder passed the retaining gland.

It proved impossible to close the valve on the tapping into the process line as the piece of the probe holder that had broken away was still lying in the valve body. The piping and associated heat exchanger had to be isolated to stop the release. Fortunately, no ignition occurred, and there were no injuries.

[gas / vapour release]

Lessons

The report stated the following recommendations:

1. When working on pressure circuits on-stream, thought must be given to the possibilities of accidentally breaking containment, e.g. changing corrosion probes, inadvertent removal of thermowells etc,
 2. Materials for all components in a system subject to corrosion must be such that sudden failure will not occur leading to release of hazardous materials.
-

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Corrosion probe stress. Significant release of hydrocarbon gases when withdrawing a corrosion probe from a live piping system on the crude distillation unit. The outer probe holder had suffered stress corrosion in service, and a piece of the probe holder broken away when it was being withdrawn (defective equipment). The basic cause was that the probe holder material could not resist corrosion cracking, it was improperly selected.
[material of construction failure, incorrect material of construction]

Lessons

Materials for all components in a system subject to corrosion must be such that sudden failure will not occur leading to release of hazardous materials.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

An operator discovered that one of the rollers of a beltpress on a Waste Water Treatment Unit had broken and further damaged the equipment. The roller failed in the high pressure section due to a defective weld on the stub shaft.

These were reconditioned rollers that were installed about 6 weeks before the incident.

Total maintenance costs incurred, including charges for a rental unit, are estimated at \$80,000 (1993).

[mechanical handling equipment, damage to equipment, mechanical equipment failure, weld failure]

Lessons

[None Reported]

5931 19 January 1993

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

Location : Arizona, USA

Injured : 0 Dead : 0

Abstract

A natural gas pipeline failure caused by a dam failure.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Fire at waste gas incinerator. A small fire developed on the waste gas incinerator of a Fluid Catalytic Cracker Unit (FCCU) complex. Shortly thereafter, a gas cloud escaped through the incinerator's explosion doors. The immediate cause was product carry-over that created a fire hazard, the basic cause was instrument alarm failure and suction filters of slop oil pump were blocked. Contributing was the incorrect execution of VDU start-up. Damage repairs: \$137,000 (1993) (U.S.).

[fire - consequence, instrumentation failure, operator error, gas / vapour release, heating]

Lessons

Operational start-up procedures for units should consider possibilities of overloading/ carryover of hydrocarbons in effluent disposal streams to incinerators. Address how to avoid and what remedial actions are needed.

Slops disposal pump filters need regular attention and should be checked for cleanliness before unit startups.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Failure of belt press at a refinery.

Roller on belt press at waste water treatment unit broke, causing further damage to equipment. Failure of a weld on the stub shaft was the immediate cause and the basic cause was inadequate inspection of rollers when they were installed. The reconditioned replacement rollers were not "as good as new".

Losses: equipment replacement, repair, cost of maintenance, including expense of rental unit \$80,000 (1993).

[weld failure, installation inadequate, refining]

Lessons

If reconditioned rollers are purchased, proper inspection must be performed before installation.

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

Location : San Lorenzo, ARGENTINA

Injured : 0 **Dead** : 0

Abstract

Hose broke on marine tanker during loading at refinery. A spill of 22 700 litres of fuel oil occurred.

[hose failure]

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.

5868 02 December 1992

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, JAN.; LLOYDS LIST, 1992, 4 DEC.

Location : Hassi Messaoud Oilfield, Sahara Desert, ALGERIA

Injured : 0 **Dead** : 0

Abstract

Corrosion in 6 inch pipeline caused spillage of 3000 litres of crude oil.

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.

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 : , 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]

5819 15 October 1992

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

Location : Ignalina, LITHUANIA

Injured : 0 **Dead** : 0

Abstract

A crack on a small pipe in a cooling system caused leak of radioactive water. Plant shutdown and leak contained.
[radioactive release, spill]

Lessons

[None Reported]

Source : ICHEME

Location : , USA

Injured : 0 Dead : 0

Abstract

A faulty valve or pump allowed more than 800 gallons of ammonia to leak and form a cloud. Led to the evacuation of 50 families in a half mile square.

[gas / vapour release, valve failure, pump failure]

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]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

When changing the bursting disc on an ethylene oxide reactor, it was found that the original disc was of the wrong type (reverse buckling) and the holder had been deliberately modified to accept the disc. The locating pin had been ground off.

[near miss, incorrect equipment installed, reactors and reaction equipment]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Hydrocracker reactor effluent pipeline failure and fire at a refinery.

A 6 inch outlet elbow of a first stage reactor effluent air cooler failed, resulting in a fire. There was some damage to equipment. The presence of aqueous ammonium bisulphide resulted in erosion/corrosion that caused the pipeline failure. The cause was inadequate inspection for the detection of general and localised corrosion.

[fire - consequence, inspection inadequate, reactors and reaction equipment, cracking]

Lessons

An adequate inspection programme to detect general and localised corrosion/erosion attack is essential, coupled with a good recording system for all findings.

Source : FIRE PREVENTION NO. 258, 1993, APR.; ASSOCIATED PRESS

Location : Kansas City; Missouri, USA

Injured : 1 **Dead** : 3

Abstract

Welders working on guard rails on the top of a storage tank sparked an explosion in the tank containing residues of ethyl alcohol. The explosion moved the tank 65 feet and damaged 4 other tanks. There was no fire. Fatality.

[welding, storage tanks, damage to equipment]

Lessons

[None Reported]

5771 01 September 1992

Source : THE CHEMICAL ENGINEER, 1992, 10 SEP.; LLOYDS LIST, 1992, 9 SEP., & 14 OCT.

Location : Eleusis; Elefsina; Athens; Greece, GREECE

Injured : 30 **Dead** : 14

Abstract

An explosion occurred in one of the crude units during a change of shifts. Cause attributed to corrosion of a steel pipe in the crude oil distillation column due to the collection of corrosive compounds during shut-down periods. 7 mm of pipe thickness had corroded away. Fatality.

Lessons

[None Reported]

Source : CHEMICAL ENGINEER, 1994, 26 MAY.

Location : Sellafield, UK

Injured : 0 **Dead** : 0

Abstract

29 kg of plutonium nitrate leaked in a stainless steel and concrete cell of a separation plant. Leak traced to weld on pressure tapping line leaving the top of the calandrias.

[weld failure, spill, separation equipment]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 123, 9-11.

Location : ,

Injured : 0 Dead : 0

Abstract

A failure of a storage vessel containing liquefied nitrogen occurred. The catastrophic failure of the vessel resulted in the collapse of almost half of the factory, damage to the walls of 25 houses and 39 cars, buses and trucks within a 400 metre radius. Fragments of the vessel were projected up to 350 metres (part of the top head of the outer shell, 1.5 metres wide and 8 mm in thickness). The estimated property loss was 440 million yen.

After investigation it was found that the rupture disc had ruptured outwards despite the closed inlet valve.

The following conclusions were made:

1. The isolation of the relief valve was carried out at some time after the inspection, probably as a result of the relief valve lifting or having been carelessly closed. As a result the vessel was put under closed conditions.

2. Under closed conditions the pressure rose as a result of the inflow of heat until the bursting pressure was reached.

3. The inner shell burst at about 70 kgf/cm² followed immediately afterwards by the outer shell.

[vessel failure, bursting disc, damage to equipment]

Lessons

Operators must have a basic knowledge of safety and an understanding of how it applies to their daily tasks.

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]

Source : ICHEME

Location : , TAIWAN

Injured : 0 Dead : 0

Abstract

An explosion occurred during a normal operation of ethylene oxide and glycol system, when the glycol flash column failed, breaking into essentially two pieces.

The vessel burst was opposite the feed point between the stripping and rectification sections and continued to crack in almost a complete circle around the circumference of the vessel.

It is believed that the cause of failure was erosion. No evidence of ethylene breakthrough was seen. Therefore the failure was purely mechanical. The vessel was nine years old.

[normal operations, mechanical equipment failure]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1992, NOV.; LLOYDS LIST, 1992, 12 SEP.

Location : Avila Beech; California, USA

Injured : 0 **Dead** : 0

Abstract

Transportation. A pipeline leaked 6300 gallons of crude oil due to failure of cathodic protection producing a hole 6 inches diameter.
[corrosion, spill]

Lessons

[None Reported]

5736 02 August 1992

Source : LLOYDS LIST, 1992, 8 AUG.

Location : Pickering; Lake Ontario, CANADA

Injured : 0 **Dead** : 0

Abstract

3000 litres of radioactive heavy water leaked from a cracked tube in a heat exchanger system causing shutdown of water treatment plant.

[tritium, radioactive release, plant shutdown, spill, heating, drains & sewers]

Lessons

[None Reported]

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

Abstract

In August 1991, a hydrocarbon vapour leak was detected on a weld of an 8" nozzle on the reactor vapour line at a location about 3m upstream of the line's entry to the main fractionator.

The vapour leak did not ignite, and a temporary clamp fitting was installed while x-ray measurements were taken. From these measurements it was clear that heavy erosion/ corrosion had taken place. It was decided to shut the plant down immediately, because temporary repairs were judged to be too dangerous.

The next planned maintenance shutdown was for 1994, with the unit having been on stream for 15 months since its last overhaul.

The nozzle was found to be in bad condition, with remaining thickness of only 2mm below a weld nearly completely around the whole circumference, with a 1mm diameter hole at one point where the leak occurred.

The nozzle is normally steam flushed during operation through a steam line with a 1/16" restriction orifice. After the last start-up, however, it was detected that the flushing connection has blocked and attempts to free it were unsuccessful.

The absence of nozzle flush is thought to have caused this abnormal erosion/corrosion, which was not anticipated to be likely to produce such a severe result.

[reactors and reaction equipment]

Lessons

The lesson to be learned is that, if the unit cannot be operated according to design, it must be made sure that the possible consequences are understood with additional inspection: in this case, frequent x-ray measurement.

5729 28 July 1992

Source : OIL AND GAS JOURNAL, 1993, 15 FEB.; LLOYDS LIST, 1992, 1 AUG.

Location : Westlake; Louisiana, USA

Injured : 63 **Dead** : 0

Abstract

Failure of high pressure urea reactor caused the release of a cloud of ammonia over the area and substantial damage to the urea production complex. The explosion was heard 10 miles away but there was no fire. Failure due to an improper weld on a bracket supporting a tray inside the unit. The containment vessel was corroded by carbamate that leaked through the improper weld.
[weld failure, reactors and reaction equipment, corrosion, gas / vapour release]

Lessons

[None Reported]

5727 26 July 1992

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1992, OCT.; LLOYDS LIST, 1992, 31 AUG.

Location : Sacha Norte, ECUADOR

Injured : 0 **Dead** : 0

Abstract

A spill of 210,000 gallons of oil occurred causing pollution of a river. Cause attributed to a faulty separation valve between crude and formation water.
[valve failure]

Lessons

[None Reported]

5723 23 July 1992

Source : ASSOCIATED PRESS; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1992, OCT.

Location : Orem; Utah, USA

Injured : 0 **Dead** : 0

Abstract

Power supply failure while adding materials, trimethyl phosphite and methyl chloroacetate, to a vat stopped a mixer and the mixture overheated causing a release of vapours.

[overheating, agitation failure, gas / vapour release, mixing]

Lessons

[None Reported]

1079916 July 1992

Source : ICHEME

Location : , UK

Injured : 1 Dead : 0

Abstract

The nozzle of a hydrogen cylinder fractured releasing hydrogen which consequently ignited.

One person suffered flash burns as a result of the fire.

[gas / vapour release, fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

The floating roof of a catalytic distillate tank sank during heavy rains and thunderstorms.

During the evening hours and through the night previous to the incident, the area experienced severe thunderstorms, high winds and record amounts of rainfall.

At the time of the incident the tank was feeding to the gasoline blender, when at approximately 08.30 hours according to the tank gauge record the gauge suddenly dropped from 26 ft to 3 ft.

During the hours before the roof sank, the tank's gauge stuck and remained static for approximately 11 hours. (The gauge had stuck a number of times in the weeks previous to this event.)

After receiving internal complaints of odour that morning, operators began to look for the source and discovered product escaping from the tanks roof drainage system and coming out from under the floor of the tank. On further checking the floating roof was found to have sunk out of sight.

The tank an external floating roof tank, 120 ft diameter x 48 ft wall height, with a safe fill height of 43 ft (85,900 bbls capacity) normally used to store catalytic distillate.

Immediate action was taken to begin emptying the tank of its contents, which was at about 26 feet (52,000 bbls). After this, normal procedures were followed to secure the tank and prepare for gas freeing. Unsuccessful attempts were made to re-float the roof with water. After water draining the tank was opened for inspection.

Extensive damage to the tank floor, roof legs, the roof itself, and the secondary seals was found. The floor and roof leg damage was apparently sustained when the roof came down; the roof having rotated out of its normal position, causing the legs to miss the striker pads and puncture the floor.

[floating roof tank, floating roof failure, weather effects, spill, material transfer, damage to equipment]

Lessons

Regular inspections of tank floating roof condition to be undertaken, especially at heavy rainfall periods.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Following record amounts of rainfall, an external floating roof on a cat distillate storage tank (85,900 bbl capacity) sank. Defective equipment and a leak in the pontoons were the immediate causes of this incident. The contributing cause was heavy rainfall which added weight to the roof. The basic causes were failure to follow maintenance practices of repairing pontoon leaks.

[weather effects, floating roof tank, floating roof failure]

Lessons

1. Tank inspection/maintenance programmes need to be kept up to date.
 2. Regular Operations inspections of tank floating roof conditions are required, especially at heavy rainfall periods.
 3. Inspection Department report findings need to be speedily discussed for priority action.
 4. Tank level gauge problems need to trigger concern and investigation.
-

Source : ICHEME

Location : , USA

Injured : 0 Dead : 0

Abstract

A small leak occurred on a discharge flange. It was discovered that the 8 inch x 10 inch safety valve on a 2nd stage reactor was iced up and appeared to be leaking at its discharge flange. Investigations subsequently found that there was a small leak to atmosphere from the discharge side of the valve through the vent hole in the valve bonnet. The unit was shut down.

After disassembling the valve for inspection, the two-ply, corrugated bellows was found to be cracked. Results of metallurgical analysis indicated that the bellows failed from

severe stress corrosion initiating from the discharge side, i.e., outside of the outermost ply.

A staggered crack in total of 7 inches in length was visible on the outside bellows on the first convolution above where the bellows is welded to the disc.

General corrosion of both bellows occurred where acid was trapped below the plies thereby initiating cracks on the inside bellows.

The valve was temporarily removed from service for repair and the unit brought back on line. (Maintenance and repair costs were \$61,000 (1992) with the cost of productivity of \$1,900,000 (1992).

[reactors and reaction equipment, spill]

Lessons

[None Reported]

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

On May 11, an operator charged makeup DIB and xylene to a batch of maleic anhydride. Some time later he charged the styrene chaser and tried but had difficulty getting the xylene flush charged. Another operator found and closed a DIB charging block valve which was in the open position. Once this valve was closed the xylene flush was completed smoothly. The batch processed to completion without incident.

On May 12, raw material charging on the next batch proceeded normally. The mix was warmed to 114 degrees C and the first catalyst shot made. As the exotherm began, the normal cooling was applied. Upon observing that the temperature rise was not abating, full cooling was applied. The exotherm continued and the operator realised he was not able to control it. The pressure began to increase and the operator opened the 3 inch vent line to an attached vessel but the pressure increase continued. The operator opened the normal vent to the roof through the condenser and vacated the area. The reactor pressure increased to a reported 40 - 50 psig. The pressure blew out the reactor agitator seal O-ring and spewed a heavy concentration of vapours into the department. A 35 psig relief valve did unseat but the 50 psig rupture disc did not burst. The Plant had experienced an uncontrolled runaway polymerisation in the reactor while manufacturing crude polymer.

[maleic anhydride, styrene, xylene, processing, reaction, reactors and reaction equipment, agitator, non-return valve, environmental, runaway reaction, valve failure, inadequate engineering, design or procedure error]

Lessons

The runaway reaction was a direct result of styrene backflowing into the DIB charging line via the open block valve and a faulty antiquated check valve during the first batch. During the second batch, the normal DIB charge in fact included the styrene. The styrene/maleic copolymerisation reacted much more rapidly than the normal DIB/maleic reaction and exothermed uncontrollably.

Some key contributing factors were:

1. Operator not closing shutoff/charging valve after completion of charge, or opening wrong valve and leaving it open, or not checking valve alignment.
2. Antiquated/faulty check valve in DIB line.
3. Agitator seal pressure design insufficient to hold pressure at the rupture disc setting.
4. No easy means to source emergency quench water, nor a clear criteria for when to inject quench water.
5. Failure of operator(s) and Team Manager to realise potential consequences of the abnormal valve arrangement when it was discovered.
6. Actuator for the department evacuation signal required someone holding it to keep it activated/actuated (was in the locale of the vapour cloud around the reactor).

The actions taken as a result of this incident were:

1. Agitator seal replaced with one of split design and rated for 100 psig.
2. Header charging valves modified to allow only one valve open at a time (to charge the wrong material would now take 4 separate sequential incorrect actions). Used and cumbersome piping was removed and replaced with very direct/simple piping to minimise the potential of material going anywhere but to the meter centre.
3. Antiquated non-return (check) valves on raw material charging lines have been removed and new ones installed within the modified piping outlined in 2 above.
4. All other charging lines have been surveyed and non-return valves have been installed as appropriate.
5. An easily installed and highly visible means of sourcing emergency quench water has been installed and will be accompanied by special instructions in the SOP and on the floor.
6. The knock-out pot has been installed on the normal vent line off the condenser to forewarn of a heavy/condensable vapour flow past the condenser and/or prevent minor upsets from purging small liquid quantities to the outside environment.
7. The department evacuation actuator will have latching mechanism installed.

Source : LOSS PREVENTION BULLETIN, 129, 10-11,; LLOYDS LIST, 1992, 29 MAY.

Location : Tarragona, SPAIN

Injured : 0 Dead : 0

Abstract

During normal operation of this ethylene plant, a leak was detected in the cooling/heating water jacket for the upper zone reactor tubes. The ethylene plant was immediately shut down and the pressure in the reactor was gradually reduced to 25 bar. Water was drained from the jacket and ethylene detectors were inserted to identify the location of the gas leak. Ethylene gas was reintroduced into the system and the pressure was gradually increased to 980 bar. When the source of the leak was detected the operators started to reduce the pressure in the reactor and separators.

As the pressure in the reactor and separators started to decrease, a loud noise was heard in the control room. Operators believed the noise to be a large ethylene leak and actuated the emergency dump system which closed the ethylene and oxygen inlet valves of the reactor, released gas through the reactor vents, and closed the outlet valve of the high pressure separator. Almost immediately after the emergency dump system was actuated, an explosion occurred which was followed by fire.

The explosion caused substantial damage to equipment and buildings within a one-half mile radius of the plant and severely damaged the concrete containment bunker for the reactor and high pressure separator. The walls of the bunker remained standing, secured by the steel reinforcing, but had been bowed outwards. The damage patterns suggest that there were two simultaneous vapour cloud explosions, one within the bunker and one centred above the top of the bunker. The fire following the explosions was extinguished within 10 minutes as the flow of gas was shut off. Fire damage was observed on the top of the high pressure separator and at the bottom valves of the low pressure separator.

The initial release of ethylene gas during testing came from the high pressure separator lid, which was secured to the body by a series of studs and was sealed with a steel ring. The leakage was said to have been caused by differential thermal contraction of the seal and the lid/body assembly following the introduction of cold ethylene gas into the reactor and separators for test purposes. There was no evidence of fracture or mechanical failure on either the seal ring, lid or body of the high pressure separator. Additional ethylene gas was released from the reactor and separators when the emergency dump system was actuated. The source of ignition for the ethylene gas was failure of insulation on electrical wiring for a remote operated dump valve. This valve would have been operated with electrical sparking during the emergency dump system actuation.

[fire - consequence, reactors and reaction equipment]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A small fire occurred in an ethylene oxide unit when a flange leak caught fire. An orifice flange had developed a leak and was dripping ethylene oxide. The oxide dripped onto a cable tray underneath. The PVC of the cables was weakened by ethylene oxide attack. A short circuit was made which ignited the ethylene oxide. The leak became bigger due to expansion of the long bolts used to assemble the orifice flanges.

[fire - consequence]

Lessons

[None Reported]

5656 04 May 1992

Source : FIRE PREVENTION NO. 255, 1992, DEC.; EUROPEAN CHEMICAL NEWS, 1992, 25 MAY.

Location : Jarrie, FRANCE

Injured : 2 Dead : 1

Abstract

An explosion occurred at a hydrogen peroxide plant due to technical failure of computerised control system.

The plant was completely destroyed.

[process control & instrumentation, control failure, computer failure, fatality]

Lessons

[None Reported]

Source : LLOYDS WEEKLY CASUALTY REPORTS 288/7

Location : Keamari; Karachi, PAKISTAN

Injured : 03 Dead : 0

Abstract

A fire occurred at a terminal and destroyed a section of pipeline. Fire broke out while welders were fixing a pipeline valve. Sparks from welding fell on oil. Fire controlled in one hour.

[fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A road transportation incident. During delivery of bulk polyethylene a silo computer locked out. The road tanker driver received no warning and was not able to shut off the donkey engine before damage to the engine occurred. Extensive repairs to the engine were necessary.

[loading, unloading, computer failure, silo/hopper, damage to equipment]

Lessons

[None Reported]

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

Location : , MOZAMBIQUE

Injured : 0 **Dead :** 0

Abstract

A marine transportation incident. Hull cracked on marine tanker with 60,000 tonnes of fuel oil and later broke in half under tow and sank. Large oil slick.
[sinking, spill]

Lessons

[None Reported]

5635 14 April 1992

Source : LLOYDS LIST, 1993, 16 JAN.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1992, JUN.

Location : Off Jieh, LEBANON

Injured : 3 **Dead** : 6

Abstract

A marine transportation incident. Mooring ropes broke on marine tanker in heavy weather at offshore terminal. Discharge hose parted and hit stern causing sparks which ignited the gasoline. Fatality.

[weather effects, fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A small phosphorus fire occurred as a result of a pinhole in a pipe at a rail car unloading station. The pipe leaked due to severe corrosion.

[fire - consequence]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, 1995, OCT.

Location : Keith, Alberta, CANADA

Injured : 0 Dead : 0

Abstract

A rail transportation incident. A rail tanker loaded with 90 tonnes of molten sulphur caught fire in the marshalling yards. The tanker was found to have severe corrosion around the safety relief valve which penetrated 75% of the weld thickness securing the valve fitment. The exterior gave no indication of the corrosion which had progressed from inside the tanker.

[fire - consequence]

Lessons

Corrosion of the weld produced 'mackinawite', a spontaneously combustible product when exposed to air and possibly provided the source of ignition. A survey of 128 rail tankers found that 74% had incurred a tank shell loss of 16% or more at the manway area. As a result of this accident, rail tanker specifications for molten sulphur must now have a protective coating or corrosion resistant material in areas of high heat flux. They must also be tested and inspected every 10 years.

1996 14 March 1992

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A coker gas oil pipeline rupture. The intermediate reflux line of this coker bubble tower at a refinery failed during recommissioning, resulting in a spill of heavy gas oil. The cause was failure of the reflux line due to internal corrosion which was caused by changes in operation and crude processed that accelerated the corrosion rate. In addition incorrect pipe material was used and the monitoring system was not designed to facilitate easy analysis of the database to identify problem areas.

Maintenance loses and repair costs: \$155,000 (1992). Production loss: \$32,000 (1992).

[pipeline failure, design or procedure error]

Lessons

Improvements needed to the PCMS program to incorporate design operating temperatures and pressures, increase in data input and analysis to identify problem areas before failure.

All changes in crude oil slate need to be evaluated within the Management of Change procedure to ensure possible changes in deterioration rates for plant and equipment are identified and handled correctly.

Source : LLOYDS WEEKLY CASUALTY REPORTS 288/1

Location : Penza Oblast, RUSSIA

Injured : 0 Dead : 0

Abstract

Transportation. A section of an oil pipeline ruptured 5 km from a village. 6000 cum (cubic metres) of crude oil was spilled causing river pollution. Presumed cause was corrosion in a bend in the pipe.

Lessons

[None Reported]

5576 12 February 1992

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

Location : Near Houston; Texas, USA

Injured : 0 Dead : 2

Abstract

An explosion from a spark during handrail welding above tank holding water used to extract ethylene and propylene from underground salt dome storage.
Fatality.

Lessons

[None Reported]

5571 06 February 1992

Source : LLOYDS LIST, 1992, 7 MAR.

Location : Chester; Pennsylvania, USA

Injured : 0 **Dead** : 0

Abstract

Transportation. Pipeline ruptured at a joint causing a spill of 50 000 gallons into a creek. Joint ruptured due to metal fatigue. The oil leaked into the ground of a pump station, down a storm drain and into the creek.

Lessons

[None Reported]

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

Abstract

In February, 1992, a loud hissing noise was reported from Unit A. Investigation revealed that the HP Flash Gas Air-fin Cooler, 305-C, had sprung a tube leak at its outlet (north) end.

Immediate actions were taken to shut down Unit A, and shutdown was achieved in a safe and efficient manner without further incident or injury.

Both banks of the cooler were subsequently opened and cleaned for inspection. Severe erosion of the return pass outlet tube ends was apparent, particularly at the centre of each row.

The tube responsible for the major leak had burst at the bottom, adjacent to the tube sheet.

Hydrotesting revealed that several other tubes had also been leaking through their roll-joints due to tube end erosion.

The tube which had leaked and other very suspect tubes were plugged and welded, these totalled 34 out of the 140 tubes in the outlet pass.

A satisfactory hydrotest at 140 kg/cm² was finally achieved after 10 days and the unit was returned to operation the following day.

The incident cost \$504,000 (US) (1992) in lost throughput and \$30,000 (1992) in repair costs.

Inspection of 305-C tubes, both during and after the repairs has shown that the corrosion-erosion was very localised, and confined to the outlet ends of the return pass over a length of only some 200mm.

The burst location was lost during cutting; but there is no doubt that the rupture was due to severe thinning along the bottom.

The inspection findings, coupled with the history of corrosion in Unit A reactor effluent, strongly suggest that the failure was caused by ammonium bisulphide condensate corrosion-erosion.

[material of construction failure, cooling equipment]

Lessons

1. Establish a proper corrosion inhibition/monitoring program based on condensate sampling. Fit calibration cylinder to inhibitor pump.
 2. Replace wash water pump with one of full capacity/high reliability.
 3. Ensure wash water remains oxygen free.
 4. Improve inspection monitoring and apply full strength hydrotests.
 5. Dependent upon the above, reconsider future strategy on metallurgy upgrading and/or wash water injection.
 6. Ensure the lessons from this incident are applied to other units with similar problems.
-

Source : LOSS PREVENTION BULLETIN, 107, 17-20.

Location : ,

Injured : 0 Dead : 0

Abstract

An incident occurred in the regenerator section of a Fluid Catalytic Cracker Unit (FCCU) 50 hours after a unit shutdown. The shutdown was not planned and was caused by mechanical failure of the regenerator airblower.

FCCU regenerators are large vessels containing beds of fluidised catalyst in which air is used to burn off both carbon, referred to as coke, and hydrogen based material trapped in and on aluminium silicate catalyst which has a porous structure. The air flows into the regenerator through a two, tier air grid system from an airblower.

Two days before the incident, the airblower tripped out due to activation of the airblower vibration shutdown monitoring equipment. The vibration was caused by a mechanical failure of one of the air blower rotor discs.

This initiated automatic shutdown of the unit. As a result the regenerator fluidised bed slumped and steam was automatically injected into the catalyst bed.

The air blower rotor assembly was inspected through a small manway inspection door, visually confirming that the rotor was damaged and would have to be repaired. At the same time the decision was taken to enter the regenerator/riser/reactor circuit to undertake other necessary repair work.

Over the subsequent 2 days operations staff prepared the regenerator for manway removal. It was recognised that catalyst temperature would be higher than usual. Previously when the air blower had tripped and the manways to the regenerator, riser/reactor and ductwork, including the waste heat boiler (known as the cat circuit) had been opened, the equipment had been gas tested and entered without incident. During the preparations a large butterfly valve and a critical flow nozzle were removed from the ductwork to the flue. These were normal procedures in preparing the cat circuit for entry. The removal of these items reduced the draught of the flue on the regenerator and would have contributed to an oxygen deficiency in the regenerator.

After all the necessary blinds had been inserted, operational procedures permitted the regenerator manways to be removed to allow the final vacuum truck removal of remaining catalyst.

On the day of the incident, work commenced to remove one of two manways on the regenerator, at the base about 9 m above ground level. A small manway was opened first to ensure that there was not a residual mound of hot catalyst resting against the large manway door that might have slumped onto those on the access platform. This manway was opened as the system was considered to be an air system open to atmosphere by virtue of the flue connection.

Work then proceeded to open the large 1.5 m manway. With one bolt remaining on the large manway, some witnesses reported a rumbling noise inside the regenerator. It was immediately followed by an orange-red flash which came out of the left side of the manway, from where the penultimate bolt had been taken.

Simultaneously a flame front and hot particles exited from the small manhole on the other side of the regenerator platform.

The flame and pressure front passed through the regenerator into the downstream flue ductwork. Where the duct was broken and plant items removed flame fronts and hot catalyst exited.

After a period of a few seconds, there was a louder secondary noise which emanated from the waste heat boiler and associated flues which sustained structural damage.

The following conclusions were made:

This unique incident was due to the ignition of hydrogen, light hydrocarbon gases and carbon monoxide. These gases were generated by contact of unregenerated catalyst with steam in an oxygen deficient atmosphere. Removal of a manway to allow access for vacuum truck removal of catalyst allowed oxygen re-enrichment of the internal atmosphere and the re-establishment of conditions that permitted ignition. Lighter-than-air combustible gases were trapped in a reservoir created by the internal configuration of the plant. The opening of the manway caused some gases to be dispersed into the ductwork prior to the ignition.

[catalytic cracker, blower failure, fire - consequence, oxygen enrichment, fluid cracker]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

On January 7, 1992, an operator discovered that the bunded area of Tank A was flooded with product.

At the time, a portable, diesel driven centrifugal pump was connected by hoses to tanks A and B to allow lowering of Tank A, so that work could be done on its level indicator.

The operator immediately shut off the lowering line from Tank A and called for assistance.

Fire crews and vacuum tanker were mobilized to pump out the bund.

A gas test in the area revealed an LEL of no greater than 25%, and a decision was made by the Shift Supervisor not to declare a refinery emergency. With the fire crew on standby, removal of the spilled product commenced at 20.10 hours. Of the estimated 50,000 litres spilled, some 40,000 litres were recovered.

The release occurred due to the failure of one of the suction hoses to the centrifugal pump. The investigation revealed that neither the hoses nor the coupling were suitable for hydrocarbon service and that potential hazards are associated with this type of pump. It was also found that there were no written procedures available for setting up and operating temporary pump-over facilities.

[hose failure, refining, design or procedure error]

Lessons

1. Procedures should be prepared, giving clear instructions on what equipment is to be used for fluid transfers involving hydrocarbons.
 2. In this case no clear distinction has been made in procedures between hydrocarbon transfers and general duties such as pumping out sumps and sewer boxes - instructions should be issued stating that, whenever possible, only PSI tested and marked (in date) hoses are to be used for hydrocarbon transfers, and that air driven or manual start diesels are to be used.
 3. Hose connections should be flanged to ANSI standards or be camlock couplings with an approved hydrocarbon resistant seal (e.g., nitrile); aluminum couplings not to be used on caustic service.
 4. If hire equipment is ever to be used for hydrocarbon duty, it should be specified by a competent person and inspected and tested by PIS before a permit for use is issued.
 5. There is a need to review the requirement to do pump-overs, especially those relating to product movements, eliminating all non-maintenance related pump-overs. If analysis justifies continuation of pump-overs then at least one set of suitable hydrocarbon resistant hoses and an approved pump should be held for emergencies.
-

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

Location : Menlo Park; California, USA

Injured : 3 **Dead** : 1

Abstract

Pressure relief valve failed on canister containing deuterium oxide at a laboratory. A manual attempt to open the canister led to an explosion and the death of a cold fusion researcher.

[laboratory work, valve failure, containers, fatality]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 1 Dead : 0

Abstract

A fire occurred in a carbonisation plant during the morning hours. Hot oil suddenly shot out over an operator working in the vicinity of a reflux pump and the oil ignited a short time later.

The plant operator sustained 2nd degree burns to his face, arms and legs, and 3rd degree burns to his hands and face. The worker was given first aid and taken to a local hospital.

The fire which developed engulfed an area of 10-15m² with flames reaching a height of 15m.

The fire brigade, who arrived at the scene some 3 minutes later were able to extinguish the blaze after about one hour, using several water monitors.

On the reflux pump, a 18mm blind screw fitting, in the pump intake, had loosened. The reflux pump was part of a hot oil system. The oil used had a somewhat higher sulphur content than crude oil. The entire circulation system had been constructed from carbon steel some 20 years before.

At the end of 1980, slight corrosion was detected in the wiring (although wiring may mean piping) system. Although this was only slight, the wiring system was renewed using steel with a 5% chromium content. At that time the pumps showed only slight material degradation and were, therefore, not renewed.

The oil was at a temperature of 350 degrees C and a pressure of 4 bar at the pump suction. The sulphur content of the oil was 0.6% by weight.

Examination of the pump after the incident revealed that the internal wall thickness of the cast pump casing had been reduced by 2mm. The failed screwed-in fitting had corroded from 44mm to 36mm. Corrosion in the stator bore of the pump was considerable and finally resulted in the thread of the fitting failing.

[fire - consequence, leak, oil - hot]

Lessons

1. Inspect other pumps in this case of the 57 pumps inspected 2 were found with similar problems.
2. Proactively check pumps and fittings, do not rely on overhauling in the workshops as the method of inspection.
3. The sulphur content of the oil is regarded as the prime cause of the corrosion. Previous experience had shown that significant corrosion was to be expected at temperatures around 400 degrees C (752 degrees F). It was not expected at the pumping temperature practiced of between 320 degrees C and 350 degrees C (608 degrees F and 662 degrees F), and this was an important realisation for the company.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

An operator attempted to clear a blockage caused by caustic soda in the drain line at the bottom of a depropanizer reboiler. The operator dismantled the drain line leaving a 50mm gate valve in place. This was found to be blocked but was eventually cleared using steam. A mixture of butane and butylene at 17 bar pressure then started to escape from the valve.

This valve was closed by operators using breathing apparatus in accordance with the emergency procedures, but not before the depressuring valve was opened. A decision was taken to reduce pressure in both the depropanizer and an associated propane/propylene splitter. Gas was diverted into the flare line via a 400mm ball valve. Just upstream of the point where the flare line met the flare header were a 250mm diameter sump and a drain line.

The sump and drain line were blocked by a mixture of scale and discarded welding rods which, according to the company, were probably left by contractors who worked on the plant in 1988. The blockage had allowed 30m³ of liquid to collect in the flare line.

When the diverted gas hit this huge slug of liquid, the vibration dislodged about 100m of the flare line, which fell 10m to the ground and buckled on impact in the area of contact.

The buckling of the pipe was typical of that seen in ductile collapse of steel pipe, where the walls of the pipe fold inwards to form uniform lobes on the inside of the pipe. At the trough between two of the lobes there was a series of long open-mouthed cracks. The region of cracking extended over a total length of approximately 170mm. The cracks were found to have propagated to a depth of 7.7mm in one place, leaving 2.3mm of metal remaining from a nominal thickness of 10mm. The length of the damaged pipe was quite small.

The view of the inspector was that the incident could have been a major disaster in that their calculations showed that, if there had been a leak followed by a vapour cloud explosion, there would have been total destruction of plant and equipment within a 60m radius and collapsed buildings within 240m.

Since the incident several hundred thousand pounds have been spent on improving the flare system.

[processing, flow restriction, corrosion, solids deposition, gas / vapour release]

Lessons

The above incident provides a reminder of problems which can be experienced with corrosion and deposition in flare pipeline systems. Unfortunately, blockage and corrosion is probably most likely to occur at the low drain points provided specifically to remove liquid condensation.

Finding problem points is not easy. In the past blockages have been looked for by pipeline radiography with some success, followed by selected cleaning of sections, such as bends, crossovers, and expansion loops.

The use of higher grade steels and purging at dead ends of the flare line systems are methods used at some sites to reduce problems.

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, 1992, FEB.

Location : Salt Lake City; Utah, USA

Injured : 0 **Dead** : 0

Abstract

Hose broke on rail tanker to tank connection and released sulphur dioxide. Emergency team shut valve after 95 minutes. Cloud drifted over city.
[hose failure, gas / vapour release]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A pump seal leak on a booster pump started a fire causing shut down of the crude unit. Fire propagated into overhead equipment. Actual Losses \$5.5 million (1991) for equipment repair/replacement. It was found that no preventive maintenance had been carried out.
[fire - consequence, seal failure, maintenance procedure error]

Lessons

Motorised operating valve seal pressure switches for critical pumps e.g., hot oils or vaporizing liquids should be tested.
Perform vibration analysis on critical machinery.

Source : ICHEME

Location : ,

Injured : 1 Dead : 0

Abstract

An incident occurred when condensate piping in an alkylation unit area failed due to severe corrosion caused by a leaking acid vaporiser heat exchanger bundle on the acid rerun system.

Following general odour complaints, which could not at the time be traced, a series of condensate lines around the acid vaporiser failed, emitting clouds of steam containing trace amounts of hydrofluoric acid. Immediate emergency steps were taken to isolate the source of the leak; a cloud of steam with HF persisting for some 45 minutes until the leak source was isolated and the condensate lines depressured.

Operators responding to the emergency, suffered throat irritations and some minor facial burns from the acidic steam mist. One operator was sent to hospital with facial burns.

A condensate flash pot received some corrosion damage.

Low pH condensate was sent to the boiler area with corrosion damage to a condensate storage tank. Equipment damage estimates include \$27,000 (1991) repair for the condensate flash pot, and \$96,000 (1991) for repair of the condensate tank.

[pipeline failure, mechanical equipment failure, gas / vapour release, damage to equipment, storage tanks]

Lessons

[None Reported]

5474 15 November 1991

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

Location : Botlek; Rotterdam, NETHERLANDS

Injured : 31 **Dead** : 0

Abstract

Power cut and backup generator failure caused chlorine to leak for 10 minutes from plant.

[power supply failure, gas / vapour release]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 3 Dead : 0

Abstract

HF (hydrogen fluoride/hydrofluoric acid) alkylation unit vaporiser leak on a refinery. Failure of condensate piping, due to severe corrosion caused by a leaking acid vaporiser bundle, created a release of a HF vapour cloud. Three operators responding were injured. Damage to several sections of condensate piping and a condensate storage tank.

Actual losses \$1,437 (1991) cost of investigation; \$65,900 (1991) in equipment and property damage, undetermined cost for medical treatment. The cause of the incident was insufficient maintenance practices to prevent ion detector plugging and insufficient knowledge of process abnormalities and HF hazards.

Contributing was failure of the acid vaporiser bundle and failure of the fluoride ion detector in the condensate system.

[mechanical equipment failure, design or procedure error, refining, storage tanks, pipework, damage to equipment, injury]

Lessons

The following recommendations were made:

1. Critical equipment should be identified and placed on a frequent preventive maintenance schedule.
 2. Operating training should address abnormalities in process operation.
 3. Provide pH analyser in Alky unit to replace litmus paper.
 4. Provide refresher training on the effects and hazards of HF and procedures for first aid treatment.
 5. Provide an alternate escape route from the top of the acid settler.
 6. Evaluate safety of ladders with cages in areas requiring use of a "D" suit.
-

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

In November 1991, as a result of borehole measurements taken as part of the monthly subsurface oil monitoring program, it was discovered that the level of free oil on the water table had increased substantially. It was subsequently established that approximately 2390 litres of alkylate had been lost from a storage tank, from two failures in the tank floor.

The tank had been recommissioned on October 19, 1991, after a major overhaul.

The alkylate was lost to ground from the tank when the tank failed in two locations, 1m apart, at the lap weld between the 6mm floor plate and the 9mm annular ring. The failures were caused by severe localized wastage of the weld metal.

Such localized corrosion is not uncommon in tanks and, in this case, it was visually evident and should have been observed by the inspector in meeting the requirements of a major tank overhaul.

From the evidence, it is clear that the floor of the tank was never thoroughly inspected and yet the inspection report was subsequently signed and issued, and endorsed to the Year 2006 for the next thorough inspection of the tank.

[weld failure, inspection inadequate, spill, storage tanks]

Lessons

Make sure that appropriate line management actions are taken where there have been failures in carrying out responsibilities.

Review inspection and reporting procedures, incorporating forms and/or checklists as appropriate to ensure that a tank cannot be returned to service before they have completed their responsibilities.

Hydrotesting of tanks to be restricted to those tanks which have had major structural repairs or modifications as per the appropriate codes, i.e. neither practical or justified to so test all tanks returning to service.

Upgrading of the tank gauging system to be extended to cover intermediate tankage, so that all oil movements can be more closely monitored, and discrepancies identified immediately.

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

Location : , GULF OF MEXICO

Injured : 0 **Dead :** 0

Abstract

Shut of control valve malfunction, on an offshore platform caused a spill of 49 000 litres of crude oil.

[valve failure]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

On the 8th October, 1991, a small fire occurred on the vacuum distillation unit at a refinery, resulting in the loss of unit throughput for the associated crude distillation unit for 25 hours. Production loss due to the incident was \$16,000(1991) with maintenance costs of \$13,900(1991). The incident originated with corrosion and failure of an antifoulant injection nipple that had been put into service in the March.

The crude distillation unit bottoms are pumped through a control valve to the convection and radiant sections of the vacuum heater and then to the flash zone of the vacuum tower. The charge enters the convection heater at 665 degrees F and leaves the heater at a maximum of 775 degrees F. The control valve upstream of the vacuum heater has block valves on either side and a bypass. Situated between the block valves and the control valve are 3/4 inch drain connections with valves. The piping and the valves are of carbon steel, except the control valve trim (stem, gate and seats) which are of 316 SS and the trim on the block and drain valves of 410 SS.

A heater tube coking problem led to the introduction of an antifoulant in March, 1991, upstream of the heater. The antifoulant was injected through the existing drain connection upstream of the control valve in the heater charge line. On the 8th October 1991, this coupling and pipe nipple corroded through, causing a small fire. The antifoulant had been continually injected between March and October, except for a 45-day period in July-August.

An extensive review of the properties of the antifoulant was conducted by the Operations Department. Other refineries were contacted and the chemical was "screened" by a Chemical and Solvents Committee, which approved its use. The Material Safety Data Sheet, which was the only information available to the refinery, indicated no corrosion problems which would be encountered with the materials of construction in the unit.

After the failure of the nipple and the coupling at the injection point, the refinery were informed that the antifoulant in a concentrated state is corrosive to carbon steel at temperatures above 200 degrees F. This was never brought up during the manufacturer's discussions before injection nor by any of the other refineries consulted.

Contributing to the problem was the lack of an injection quill, which would have mixed the oil and chemical away from the pipe wall and would have reduced the corrosion at the pressure boundary.

The injection was stopped and the pipe spool between the control valve and the upstream block valve was removed. Only the coupling and the nipple were found to be corroded, these were re-placed and the spool section was reinstalled.

The small fire caused only minor insulation damage.

The pipe spool material was changed at the injection point to 316L SS. A new spool section was fabricated in 316L SS, incorporating an injection quill in the same material.

[fire - consequence, product loss, mechanical equipment failure]

Lessons

The following recommendations were made:

1. Well designed injection systems need to be constructed of suitable material so that they will withstand any possible attack from chemicals being injected and that these are well dispersed into process equipment to avoid impingement.
2. Injection chemical suppliers must provide suitable advice on how their product is to be handled and injected, e.g., possible corrosive effects, limitations on temperature at injection point, etc.
3. The original injection installation was made before "Management of Change" had been instituted. Such a review with proper input from the Maintenance, Operations and Engineering Departments should have prevented the incident.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Failure of injection nipple at a refinery.

Fire on the vacuum distillation unit resulted in a loss of unit throughput for the associated crude distillation unit for 25 hours. Production loss \$16,000 (1991), maintenance costs \$13,900 (1991). Failure of an anti-foulant injection nipple that had been in service a little more than 6 months was the immediate cause of the incident. The basic cause was that the injection nipple was made of a material that corroded from contact with the anti-foulant chemical.

[fire - consequence, material of construction failure, corrosion]

Lessons

1. Well designed injection systems need to be constructed of suitable material so that they will withstand any possible attack from chemicals being injected and that these are well dispersed into process equipment to avoid impingement.
 2. Injection chemical suppliers must provide suitable advice on how their product is to be handled and injected, e.g. possible corrosive effects, limitations on temperature at injection point, etc.
-

5435 28 September 1991

Source : ENDS REPORT NO.201, 1991, OCT.

Location : Middleton; Manchester, UK

Injured : 0 Dead : 0

Abstract

Spillage of 6,000 gallons of a surfactant into a river following failure of a storage tank containing sodium lauryl ether sulphate due to under lagging corrosion.

Lessons

[None Reported]

Source : LLOYDS LIST, 1991, 25 OCT., & 15 NOV.

Location : Haifa, ISRAEL

Injured : 0 **Dead** : 0

Abstract

A major fire, believed to have been caused by an electrical short circuit, occurred in phosphoric acid factory. Several hundred tons of alcohol burnt.
[fire - consequence]

Lessons

[None Reported]

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 3RD QUARTER, 1991.

Location : Beaumont; Texas, USA

Injured : 3 **Dead** : 0

Abstract

An explosion occurred on a coker unit after tube rupture at start-up following routine maintenance.

[tube failure]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 1 Dead : 1

Abstract

A plant technician died and a second technician was injured during a flash fire on a Vacuum Distillation Unit (VDU) at a refinery.

The flash fire occurred as a result of naphtha discharging from the vent of the VDU reflux drum, when a drawoff pump failed during the recommissioning of the VDU following an emergency shutdown earlier in the day.

It is suspected that an adjacent hot pump was the source of the ignition. The deceased technician was drenched with naphtha during the overflow, and was engulfed in the subsequent flash fire.

Earlier in the same night the deceased and three other technicians had put out a small fire. Fatality.

[fire - consequence, pump failure, spill, plant shutdown, injury]

Lessons

[None Reported]

5363 21 June 1991

Source : LLOYDS LIST, 1991, 24 JUN.

Location : Niteroi, BRAZIL

Injured : 40 **Dead** : 24

Abstract

An explosion occurred in a fireworks factory initiated by a short circuit. Windows blown out 150 metres away. Fatality.

Lessons

[None Reported]

5361 20 June 1991

Source : LOSS PREVENTION BULLETIN, 129, 11; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1991, AUG.; LLOYDS LIST, 1991, 21 JUN.

Location : Dhaka, BANGLADESH

Injured : 30 **Dead** : 7

Abstract

The failure of a welded joint between a carbon dioxide stripper and the main cylindrical body resulted in the release of high pressure gas, which consisted of ammonia, carbon dioxide, and carbamate liquids. Subsequent to the release, an explosion resulted which caused significant damage to this fertiliser plant. The source of ignition for this explosion is unknown. Fatality.

[weld failure, damage to equipment, injury, unidentified cause]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

An iso stripper level sight glass was found leaking alkylate from the Kel-F to glass interface. Upon disassembly, the Kel-F liner was found cracked and corroded and the glass etched. There were no fire/explosions or personal injuries.

The cause was found to be a cracked and corroded liner and sight glass etched from possible HF (hydrogen fluoride/hydrofluoric acid) contact and high temperatures due to thermal siphoning with sight glass in service. The basic cause was insufficient knowledge of potential hazards and engineering practices to leave sight glass open to the process. Contributing was the failure to follow procedures to block-in the sight glass when it is not in use on the HF unit. [corrosion, design or procedure error, spill]

Lessons

1. Process hazards analyses programmes should identify critical equipment for inspection and maintenance. This information should be readily available in operating plant information manuals.
 2. All sight glasses should be isolated when not in use on the HF Unit.
-

Source : LLOYDS LIST, 1991, 31 MAY.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1991, JUL.

Location : Berre-l'etang, FRANCE

Injured : 15 Dead : 0

Abstract

A leak occurred on a 50 barg ethylene pipeline near a road where a vapour cloud formed. A vehicle stalled in the vapour cloud and then restarted which ignited the vapour cloud to give an explosion. A jet fire formed which impinged on an adjacent ethylene 60 barg pipeline and which ruptured. This in turn set fire to some rubber. An investigation found that the initial leak was caused by corrosion of a section of the line. The corrosion was some 15cm long at an area of damaged wrap.

[fire - consequence, inspection inadequate, maintenance inadequate]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A level sight glass on a HF (hydrofluoric acid) alkylation unit at the refinery failed while it was being pressurised for the purposes of testing the acid ratio, and some 750 litres of acid was released to the atmosphere during an incident that lasted 15 minutes.

Both operators immediately withdrew and ran to the alkylation unit control room and shut off the control room air purge system. They then started the water deluge system and triggered the traffic warning lights on the access road.

The remote controlled deluge monitor could not be seen during the period of the release, as the vapour cloud completely enveloped it. Later it was found to have not been directly trained on the source of the leak.

At its maximum the cloud was estimated to be 10 metres high adjacent to the leak source.

There were no injuries to personnel, however it is considered that if the incident had occurred during the day shift when more people might have been in the vicinity the results could have been serious. The emergency response to the incident was judged to have been very good.

The cause of the failure of the sight glass was improper maintenance assembly. Disassembly of the segment that leaked showed that it had been assembled in an incorrect order.

[gauge glass failure, installation inadequate, maintenance inadequate, gas / vapour release]

Lessons

1. To seek alternative methods for taking an acid ratio, for example the use of flow meters if possible.
 2. To review protective clothing requirements when using sight glasses.
 3. To investigate the design of sight glasses for alkylation units, and to determine if the use of Teflon gaskets is optimum.
 4. The location of air supply hose stations to be rearranged.
 5. To implement the alkylation task force recommendations as soon as possible, in particular, to relocate/duplicate the controls for the remote operated monitor, and to investigate provision of more fixed deluge sprays on the unit.
 6. To install air locks on the entrances to the alkylation unit building.
 7. To consider the provision of breathing apparatus in adjacent areas from which escape could be difficult resulting from an alkylation unit release.
-

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 : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A tube burst in a hot oil heater resulting in a fire inside the heater at a refinery. The incident occurred during a start-up of the heater after a programmed electricity supply interruption to the area. The fire completely destroyed the heater coil with damage estimated at £750,000 (1991). There were no injuries sustained as a result of the incident. The loss of the heater caused a one week delay in bitumen deliveries.

A preliminary investigation was carried out on the day of the incident by the Operations Manager. A formal investigation team with written terms of reference was later set up by the Refinery Manager.

The Investigation Team found that the basic cause of the incident was that the heater burner was inadvertently put into operation.

Other causes which contributed to the incident were the bypassing of the protection systems and the absence of operating procedures for the heater burner.

[tube failure, fire - consequence]

Lessons

[None Reported]

5276 06 March 1991

Source : OIL AND GAS JOURNAL, 1991, 25 MAR.

Location : Corpus Christi, USA

Injured : 5 Dead : 2

Abstract

A pump failure led to toxic gas release. Water used to disperse cloud. Substance involved: hydrofluoric acid. Fatality.

[gas / vapour release]

Lessons

[None Reported]

5271 28 February 1991

Source : LLOYDS LIST, 1992, 26 MAY.

Location : Elliot Bay Washington, USA

Injured : 0 **Dead** : 0

Abstract

An engineer overfilled a diesel oil tank causing a spill of 210 gallons into the sea. The level gauge had been broken for some time.
[overflow, instrumentation failure, material transfer]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 1 Dead : 0

Abstract

A technical assistant in a works laboratory received an electric shock when working with a piece of equipment fitted with a 240v cartridge heater. The supply was wired through a Residual Current trip with a trip current of 30 mA. The trip (which was found to be in good order) did not operate, but this is consistent with the shock being relatively minor.

Investigation showed that no provision had been made for earthing the equipment. The wiring to the heater was held in place by a sharp-edged metal clamp, which had cut through the insulation and hence allowed the body of the heater to become live.

[laboratory work, electrical, lack of earthing, design or procedure error]

Lessons

The following improvements to hardware and procedures were recommended:

- provision should be made to earth the heater, to improve the design of the cable clamp and to improve the mechanical strength of the wiring.
 - the design of other equipment with similar heaters should be reviewed
 - operating procedures should be reviewed to avoid the need to handle the equipment whilst switched on if possible.
 - electrical safety awareness should be improved.
-

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A delayed coking unit coke drum overhead 6 inch quench line failed on a refinery and a major fire ensued, causing approximately \$500,000 (1991) of damage, and a much larger production loss.

The line failed as the result of high temperature sulphur corrosion, with the failure point in the highest area of temperature and turbulence. The metallurgy of the line was carbon steel, confirmed by an independent laboratory.

A thorough analysis was done of the quench line operating conditions determined that the carbon steel line routinely operated at temperatures between 550 and 600 degrees F with sulphur contents of above 0.6% (at times up to 0.82%).

The injection point of the gas oil pump-around to the overhead line quench line was the point at which failure occurred. This was to be expected, since this is the area of highest temperature and turbulence in the line.

After ascertaining that the line failure was clearly due to high temperature sulphur corrosion of carbon steel, the unit P & IDs were investigated to determine any other lines that may have been in similar service. Lines operating in a temperature range above 500 degrees F with sulphur contents above 0.5% were identified on the P & IDs, and their metallurgy in the field confirmed. A thorough examination of the unit was carried out by Inspection Department using radiography and ultrasonics to determine wall thickness and using a capacitance device for positive metals identification (PMI).

No other lines were identified as having operating conditions outside the recommended limits appropriate to their material of construction.

Numerous instances of non-specification valve and small piping installation were found, and were rectified or tagged for shutdown correction.

[fire - consequence, product loss, pipeline failure, refining]

Lessons

1. The evaluation of the Delayed Coker Unit P & IDs was an excellent method for comparing current operating conditions against design.

2. Operations Department should notify the Inspection Department weekly of all items replaced on the units, so that these can be checked by PMI for compliance with specification.

3. The coker quench line which failed was ironically the subject of numerous projects throughout the year, and should have been quickly identified as a critical line requiring routine inspections. The current practice of formal review of Process Modifications is in place to prevent just such an incident from occurring.

The procedures of HAZOPs, What If, and P & ID Reviews, etc., are crucial for finding areas of potential problems and should continue to have a high priority in new projects.

Source : ICHEME

Location : ,

Injured : 0 Dead : 1

Abstract

An oil crude unit operator sustained a fatal fall from a pipe rack of 20 feet. The operator stepped on a 1" out-of-service insulated steam line that was badly corroded. The line broke and pitched the operator backwards, head-first into the pipe ally floor.

There was an absence of a safety procedures and training programme on elevated work procedures. Alternative entry equipment (e.g. ladders, scaffolding) was not available in the immediate work area. Failure of two ground level valves and the presence of corroded pipe concealed by insulation in the pipe rack caused this accident. Fatality.

[corrosion, safety procedures inadequate, operational activities]

Lessons

1. A safety policy and/or safe practices procedure should exist that governs the procedures and precautions to be observed when engaging in elevated work.
 2. A training programme, including refresher training, on the elevated work policy, practices and equipment should be required for all new and current employees and contractors.
 3. Ladders and safety harnesses should be permanently stored and made available in operating areas.
-

5250 11 February 1991

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

Location : Llanwern; Gwent, UK

Injured : 0 Dead : 0

Abstract

A pipe fracture caused 20 tonnes of heavy fuel oil to spill into an estuary causing pollution.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 6 Dead : 1

Abstract

During the removal of a 24 inch blind from the crude unit oil transfer line, an explosion and subsequent fire resulted in seven employees being injured. One of the injured later died from 3rd degree burns.

The blind removal was the last task of the completed decoking operation on the main crude unit heater.

No hydrocarbon vapours had been detected by the safety representative after the flange bolts were "cracked", however, when the blind was partially lifted by the crane, a large hydrocarbon release occurred. A short time later an explosion and fire occurred, completely enveloping the front area of the furnace and the area adjacent to the open 24 inch flange on the transfer line.

Local and outside fire and medical units responded and were able to control the fire, permitting it to burn out in approximately one and a half hours.

[fire - consequence, maintenance, fatality, gas / vapour release, vapour cloud explosion, injury]

Lessons

The following recommendations were made:

1. Checking for hydrocarbon requires considerable technical expertise and training, e.g., difficult to detect hydrocarbons in a nitrogen atmosphere, hydrocarbons/water/steam can easily make flammable gas detectors inoperable, beware of unrepresentative dead pockets, etc.
 2. Flanges need to be cracked slowly, use of hydraulic flange splitters should be considered for large size lines, not sudden pull by crane on blind.
 3. Ignition sources must be controlled and kept away from locations where "containment is being broken".
-

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Isocracker air cooler failure at a refinery. The second stage was shut down due to a tube leak in the second stage effluent air cooler. Failure of the tube was due to acid corrosion. Water entered the second stage system from a number of possible routes; e.g. leaking stabiliser side reboiler; carry over from HP separator; water washing of the stabiliser tower. This caused an increase in the corrosion rate.

Losses: total of \$501,000 (1991), \$278,000 (1991) production loss, and \$223,000 (1991) in maintenance and repairs.

[cooling equipment, tube failure, refining]

Lessons

1. Beware of small changes in operating conditions/modifications to plant, small changes in feedstock composition, etc., can produce accelerated corrosion conditions which may occur between inspection periods.
 2. Regular removal of deposits from air cooled heat exchanger bundles/header boxes is recommended. Ensure any water flushing is done with chloride free water, and the bundle thoroughly air dried before return to service.
 3. Wash water injection systems should be carefully monitored so as to avoid any chance of them producing adverse corrosion effects.
-

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Failure of a tube in the 2nd stage effluent air cooler of the Isocracker Unit at a Refinery caused an unscheduled shutdown. There was no fire and there were no injuries. The maintenance and repair costs were \$223,000 (1991) with a production loss of \$278,000 (1991).

The basic cause for the incident was due to acid corrosion accelerated by water entering this normally dry system from a number of possible routes; e.g., a leaking stabiliser reboiler, carryover from the HP Separator, water washing of the stabiliser tower.

[piping & fittings, mechanical equipment failure, plant shutdown, product loss, damage to equipment]

Lessons

The report states th following recommendations:

1. Even small changes in operating conditions/modifications to plant, small changes in feedstock composition, etc. can produce accelerated corrosion conditions which may occur between inspection periods and hence lead to unexpected plant failure.
 2. Regular removal of deposits from air cooled heat exchanger bundles/header boxes is recommended. Ensure any water flushing is done with chloride free water, and the bundle thoroughly air dried before return to service.
 3. Wash water injection systems to be carefully monitored so as to avoid any chance of them producing adverse corrosion effects.
-

Source : LOSS PREVENTION BULLETIN, 129, 8.

Location : ,

Injured : 0 Dead : 0

Abstract

A fire occurred because of a seal failure on a pump for the crude unit atmospheric tower. Before the pump could be shut down and isolated, a second product release occurred, spreading the fire. Subsequently, an elevated reflux drum and several process lines overheated and ruptured, increasing the damage to the unit.

Because of this incident, the crude unit was shut down for six months, which resulted in a business interruption loss of approximately \$76,000,000 (1991).

[crude oil, fire - consequence]

Lessons

[None Reported]

123971991

Source : ICHEME

Location : ,

Injured : 37 Dead : 0

Abstract

During the start-up of a detergent alkylate plant; a mixture of vapour/liquid hydrocarbons and hydrofluoric acid (HF) was released into the refinery surroundings. The incident occurred due to line failure on a downstream relief valve system. Thirty-seven people were affected by the release.

An investigation into the release revealed that the line failure occurred due to corrosion thinning by HF vapours, which could accumulate and condense in a cold dead-leg adjacent to a relief valve.

[gas / vapour release, mechanical equipment failure, people, evacuation, injury]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Transportation. A refinery operated several off-property pipelines between its fenceline and its dock, traversing a common utility right-of-way. One of the pipelines was used intermittently to transport decanted oil (a heavy oil), the other pipelines were used to continuously transport light products to local pipeline distribution manifolds.

The refinery was notified that there was a decanted oil spillage along the common pipeline right-of-way.

The spillage was of about 3,000 barrels of oil and the subsequent cleanup efforts lasted for several weeks.

The failure of the pipeline was as the result of metal fatigue (confirmed by an independent testing laboratory), caused by cyclic stresses developed in the line due to thermal expansion and contraction as the line was periodically exposed to process temperatures of 200-230 degrees F with subsequent back flush at ambient temperatures.

When the initial drop in flow was noted by the barge operator the refinery pump house operator had just switched tanks in the storage area and, after checking the pump, the operator assumed that this was the reason for the drop in flow observed at the dock, and he therefore took no further action

The decanted oil rundown was going into a 30,000 bbl tank before the tank switch, and afterwards operations were from a 75,000 bbl tank, making tank gauging impracticable.

Decanted oil was barge loaded at a frequency of about twice/month, with loads of about 16,000 bbls.

When the line back flush was started, the dock operator noticed that the pump pressure was only 15 psi (normally 30 psi) but the flow appeared to be normal and this was not reported immediately.

The failure of the operators to recognize the significance of the pressure drops in the pipeline and to take action, increased the scope of spillage.

Total losses were estimated at \$830,000 (1991).

It was estimated that 2,900 barrels of oil spilled which contaminated 7,500 cubic yards of soil. Costs incurred for the cleanup amounted to about \$750,000 (1991).

[pipeline failure, refining]

Lessons

1. Intermittent operation of underground pipelines with hot transfers should be avoided unless the line have been designed for this duty.
2. Underground lines installed before modern flexibility/stress analytical techniques became available should now be analysed, especially when they are in intermittent service and/or cycle through temperature ranges greater than 100 degrees F.
3. That hydrostatic testing programmes are not likely to detect potential fatigue failures.
4. Reliable service from a system for a number of years is not a guarantee of future reliability. Unless we know how a system may fail, we cannot effectively prevent a failure.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A marine transportation incident. A marine tanker hull leak. On loading no independent inspectors were available.

The journey time was estimated to be 27 days. In the event actual journey time was 43 days due to 'prevailing strong winds and heavy seas'. On arrival the vessel anchored just outside the harbour limits awaiting a pilot to berth on the next tide.

During the waiting period for the tide, oil was observed on the sea, which the vessel obviously assumed was due to a leak from one of its cargo tanks. The vessel advised the Ships Agent and the Harbour Master of the situation.

The Harbour Master as the Port Controller has the ultimate authority as to whether a ship is allowed to enter the port.

After informing all concerned parties, the Harbour Master organised divers to inspect the vessel.

The divers confirmed a fracture of 50 mm vertical in the hull.

The crack was about 14 m below the water line, and was located below the turn of the bilge and 170 mm below a longitudinal weld, in the Port Tank area.

Crude oil was leaking out at the rate of approximately 2 litres per minute.

There were no previous repairs obvious on the hull in the area of the crack.

To stop the leakage the vessel requested permission to transfer approximately 1,500 m³ of Arab Heavy Crude from tank to an empty slops tank, and then to other tanks.

The Harbour Master gave his consent to do this transfer, provided that:

1. Resultant stresses on the hull were considered;
2. Vessel still met Port draft requirement.

The vessel completed transfer of cargo and reported that the leak had stopped.

The vessel was berthed on the next daylight high water tide with no problems, and no signs of any leakage or oil on the water around the vessel.

[spill]

Lessons

1. No defined reasons for the crack in the hull are available at present, probably requiring consideration of past records of the vessel.
 2. The actions taken by all concerned were very responsive in correcting the situation in the shortest possible time to limit pollution and the authorities were kept fully informed.
-

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

Location : , SOUTH POLE

Injured : 0 **Dead** : 0

Abstract

An explosion destroyed a liquid nitrogen storage tank due to suspected liquid pipeline fault.

[pipeline failure]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Hydrogen pressure vessel failed causing extensive property damage. Failure was due to peaking in the zone of the longitudinal welds of the pressure vessel and execution of the welding seams - inside weld reinforcement and undercutting in the transitional zone cover pass/base metal, cyclic pressure loading due to discharging and filling operation of the H2 storage tank (in this case about 1500 load cycles) and pure hydrogen.
[vessel failure, rupture, damage to equipment, material of construction failure]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 6 Dead : 0

Abstract

Release of propane and HF (hydrofluoric acid) from HF alkylation plant at a refinery.

During the start-up of the HF alkylation unit, an operator was exposed to a moderate dose of hydrofluoric acid vapours. Other operators responded and were exposed to a large release of propane and HF acid from a failed gauge glass on the depropaniser overhead accumulator water boot.

The size of the leak gave serious concern that ignition from the plant fired heater might occur, but the actions of the shift fire brigade and operators and a favourable wind direction prevented this.

Six personnel were exposed to vapours and required medical examination but fortunately did not develop lasting respiratory problems.

The primary cause of the release of HF was the inadequate design of a seal flush system from the No.2 Depropaniser to the Alky acid area.

There was inadequate use of respiratory protection by all responders, leading to exposure to HF.

The secondary, or more basic causes of the incident include various deficiencies with engineering, fire protection equipment, training, maintenance, and operating programmes.

[gauge glass failure, gas / vapour release, design inadequate]

Lessons

A number of recommendations were made:

1. Study of the seal flush system, eliminate possibilities of reverse flows.
2. Reflux pump low pressure alarm switch to be removed and checked for proper setting.
3. Develop a procedure for tagging nuisance alarms in all units to minimize interference with priority alarms.
4. To complete a 'job safety analysis' for responding to HF acid leaks and develop an emergency procedure, incorporate the procedure in the job training guide and qualification test for all relevant operators, train all supervisors on the procedure, review availability of personal protective equipment to meet procedure and practice donning emergency equipment.
5. Considerable improvements planned for the refinery fire brigade training, to include such training within job qualification tests, changes to content of drills to make these a tougher scenario, and strengthening the visibility of shift brigade leaders so that operators know who to report to, etc.
6. Ensure that HAZOP modifications are fully documented on the respective units in manuals, guides, etc., and to consider re-qualifying operators on units where extensive changes have been made.
7. Review adequacy, location and remote operability of fixed fire fighting facilities on Alky Unit, with particular reference to preventing ignition of leaks from Alky fired heater. Review provision and siting of portable monitors. Critical equipment should be identified for priority repair, ensure that fire equipment not available is logged in a suitable manner, improve routine testing of fire fighting equipment.
8. Standardise on monitor quick opening valves.
9. Investigate water supply adequacy in the Alky area.
10. Incorporate oxygen training within the Alky first aid training, to be part of the job qualification; ensure adequate "oxygen sets" availability.
11. Ensure that gauge glass cleaning on sour services is adequate, and review current operator compliance with requirements to blowdown gauges and operate gauge cocks.
12. Priority to be given repairing steam leaks in the Alky area.
13. Review staffing policy for startups and shutdowns.
14. Refresher training for operators as necessary on the use of Alky safety equipment.
15. Improve refinery call-in procedures and radio communications, that is, hardware and systems, and training in its use.

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 : ICHEME

Location : ,

Injured : 1 Dead : 0

Abstract

Fluid Catalytic Cracker Unit (FCCU) pipeline failure and fire. An 8 inch diameter gas oil line failed, releasing gas oil. During isolation of the line, a fire broke out. The failed pipe had been improperly welded.

Equipment damage/cost of repairs, \$850,000 (1990). Leak.

[weld failure, maintenance inadequate, fire - consequence, damage to equipment]

Lessons

Pipeline material and welding codes must be strictly followed, and adequate checks made to ensure that this is done. Any deviations must be subject to expert approval and be fully documented. Strict control on quality, storage, handling, and identification is required for welding rods.

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 : ICHEME

Location : ,

Injured : 0 Dead : 1

Abstract

Fire on a crude distillation unit. A rupture of the main process pipeline in the preheat section of the distillation unit resulted in a release of crude oil and a fire. There was significant damage to equipment. It was found that localised corrosion at the caustic injection went undetected and weakened the line. Contributing was an injection quill being inserted too far, the result being that caustic was being locally concentrated in the vicinity of the pipe wall. The cause was corrosion the result of recent plant changes involving the moving of injection point to a hotter point in the process, the impact of the change on the equipment was not addressed, and there was inadequate monitoring of injection points to determine the status of equipment.

[fire - consequence, inspection inadequate]

Lessons

Injection points for chemicals into process streams must be carefully designed and installed so that centres of localised stress corrosion are not created. Plant inspection programs should include monitoring of critical parts of systems where such corrosion might occur, with attention paid to "rate of change" thickness of walls to determine any unexpected increases in loss.

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 4TH QUARTER, 1990.

Location : Baglan Bay, UK

Injured : 0 **Dead** : 0

Abstract

Bearing failure on a pump led to a fire which damaged and caused shutdown of ethylene plant.

[fire - consequence, plant shutdown, processing, damage to equipment]

Lessons

[None Reported]

Source : LLOYDS LIST, 1990, 6 NOV.

Location : Lake Charles; Louisiana, USA

Injured : 0 **Dead** : 0

Abstract

Transportation. A weld failure on a 4 inch pipeline caused a spillage of residual crude oil to drainage ditch. 21,000 gallons of product entered a river.

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A fire occurred on a gasoline product pump. The pump fired due to a thrust bearing failure allowing the shaft to move forward and open up the mechanical seal. The situation was exacerbated by the fact that the seal quench water was isolated to both pumps. The fire resulted in limited damage to equipment and unit shutdown for four days.

Examination of the pump identified the likely failure chain:

1. The double row angular contact ball bearing at the pump drive end (thrust) was not an interference fit on the shaft.
2. Vibration caused fretting at the bearing locknut releasing the clamping force, allowing the bearing inner race to spin on the shaft.
3. The released locknut allowed the shaft to move 3 mm axially and the seal wedge leaked gasoline into the mechanical seal to secondary packed gland interspace.
4. Gasoline was released from a fracture in the seal flush drain line at its screwed connection to the seal interspace, plus any leakage via the packed gland.
5. The spinning inner race on the thrust bearing generated heat by friction.
6. Ball bearing clearance was lost and the bearing seized.
7. The inner race welded itself to the shaft.
8. The outer race rotated in its housing.
9. The pump was shut down ahead of the motor overload initiating a pump trip.

Although a bearing with an inadequate interference fit may run for many months without external signs of trouble, once the inner bearing race was free to move this chain of events would have progressed in minutes. The pump shaft at elevated temperature would have provided a ready ignition of the gasoline leak.

[pump bearing, pump failure, plant shutdown, fire - consequence]

Lessons

The following conclusions were made:

1. The pump thrust bearing assembly failed allowing the shaft to move forward and opening up the mechanical seal.
2. Seal flush water to both pump seals was isolated and the drain choked. The leaking seal was not contained in this closed system but leaked to atmosphere through a fractured drain line and the secondary packed glands.
3. The temperature of the failed bearing/shaft provided a source of ignition.

Recommendations:

1. Specify higher tolerance on shafts under bearings.
2. Check bearing fit tolerances of drawings of all pump shafts in use, and withdraw from stock all shafts identified to be in error.
3. Publicize the importance of checking bearing fit by measurement of shafts O/D.
4. Introduce a controlled instruction specifying the requirement to measure pump shaft O/D for bearing fit.
5. Change the mechanical seals.
6. Review the design of the seal flush water drain system to facilitate ready observation of its operation.
7. Fit blanks to pump drains.
8. Include checks on seal water flush flows in process pump check routines.
9. Initiate a scheduled fire hydrant valve operation check routine.
10. Gain advice and make recommendations on fire-fighting education for operating personnel and a policy for fire detection systems.

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

On a polyethylene plant a leak on the main body flange of a cyclone led to the release of three tonnes of ethylene over a period of 6 hours. The release was caused by joint failure of a temporary gasket. This gasket had been employed in the absence of the standard replacement gaskets. Applicable management of change procedures had been followed to approve and document the plant modification. There was no injury to personnel or damage to equipment, the release was high in the plant structure, remote from other vessels and sources of ignition, so no fire or explosion occurred. All emergency procedures were correctly observed. The failure of the gasket was the result of a number of coincidental factors which resulted in a reduction in seating pressure to a level below that required for pressure containment, the most significant being:

1. A finer than recommended surface finish on the flange faces reduced the "mechanical key" effect obtained with a coarser finish and allowed the gasket to slip more readily.
2. The presence of a pull-lift/sling diametrically opposite the leak position producing an external load on the joint
3. Inadequate torquing of the flange bolts.
4. Poor quality stud bolt cleanliness.
5. The presence of high amplitude vibrations around the cyclone area under certain operating conditions.

[gas / vapour release, near miss, separation]

Lessons

A number of general recommendations were made to avoid recurrence of this and similar incidents:

1. Incorrect tools or materials should not be used to strike the exterior of vessels such as bins or silos to alleviate internal bridging problems.
2. The findings of the investigation report should be communicated to a wider audience to heighten the awareness of possible problems resulting from pipework and equipment vibration.
3. In torquing and tensioning applications, clean, lubricated bolts and clean flange faces are required to produce secure joints.
4. For certain gasket materials, flange surface finish is a significant factor.
5. Where plant modifications are carried out which involve deviation from any internal or external standards or codes of practice, then relevant management of change procedures must be followed, and the modification must receive the appropriate level of review and authorisation.
6. Where single source gaskets or other components are used, then adequate replacement supplies must be available, and other options should be evaluated to lessen the dependence on the single source supply

5099 22 August 1990

Source : LLOYDS LIST, 1990, 1, AUG.

Location : Ulsan, NORTH KOREA

Injured : 0 Dead : 0

Abstract

A fire formed 30 cm crack in a storage tank and burned butane at the naphtha cracking plant.

[fire - consequence, storage tanks, cracking equipment]

Lessons

[None Reported]

5081 06 August 1990

Source : MARYLAND GAZETTE, 1990, 8 AUG.

Location : Curtis Bay; Maryland, USA

Injured : 0 Dead : 0

Abstract

Leak of hydrochloric acid gas lasted for 20 minutes due to pump failing to start.

[pump failure, gas / vapour release]

Lessons

[None Reported]

5079 03 August 1990

Source : LLOYDS LIST, 1990, 30 OCT.

Location : Point Fortin, TRINIDAD

Injured : 0 **Dead** : 0

Abstract

Malfunction of a pneumatic valve caused explosion in a furnace.

[valve failure]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A fire occurred on crude distillation unit. Release of naphtha ignited and started fire on distillation unit. A contributing factor was that it was a sour water system, and deposits were to be expected in valves. The immediate cause was an inability to close valve before work was begun, and there was no way to identify whether valve was closed. The basic cause was not being able to identified the hazard in preparation for work.

Losses, cost of repair and replacement, including demolition, \$14.5 million (1990).

[fire - consequence, valve failure, operator error]

Lessons

Where redundant pipework or vessels are to remain connected to a system, it must be done in such a way as to avoid dead legs/build-up of corrosive products.

5069 28 July 1990

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

Location : Great Yarmouth; Norfolk, UK

Injured : 52 Dead : 0

Abstract

Pipe fracture at tank containing 18,000 litres of 36% hydrochloric acid causing a spill. 52 people treated after breathing fumes.

Lessons

[None Reported]

5049 14 July 1990

Source : LLOYDS LIST, 1990, 18 JUL.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1990, SEP.

Location : Belozerneft; Tyumen, USSR

Injured : 0 **Dead** : 0

Abstract

Metal corrosion caused oil leak which ignited and shutdown 27 wells. 400,000 tonnes oil destroyed and 100 million cubic metres lost.

[fire - consequence]

Lessons

[None Reported]

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

Location : Duque De Caxias, BRAZIL

Injured : 0 **Dead** : 0

Abstract

An explosion caused a boiler to be destroyed in a refinery Fluid Catalytic Cracker Unit (FCCU) plant. Substance involved: fuel oil. Cause was instrumentation failure and operator error.

[refining, fluid cracker]

Lessons

[None Reported]

5042 05 July 1990

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

Location : North Shields; Tyne And Wear, UK

Injured : 0 **Dead** : 0

Abstract

A marine transportation incident. Second fire in two days at shipyard in cargo tank of oil marine tanker. Stray sparks from welding operation again suspected for ignition of residue oil. 70 evacuated from tanker.

[fire - consequence, evacuation]

Lessons

[None Reported]

5040 04 July 1990

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

Location : North Shields; Tyne And Wear, UK

Injured : 14 **Dead** : 0

Abstract

A marine transportation incident. A fire occurred in a cargo tank of an oil marine tanker under repair when residue oil ignited, possibly from welding sparks.
[fire - consequence]

Lessons

[None Reported]

5039 04 July 1990

Source : LLOYDS LIST, 1990, 5 JUL.

Location : Valetta, MALTA

Injured : 0 Dead : 0

Abstract

Transportation. Hair line crack in fuel oil pipeline caused spillage in harbour.

Lessons

[None Reported]

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

Location : Vincennes Bay, ANTARTICA

Injured : 0 **Dead** : 0

Abstract

A storage tank cracked during intense blizzard causing spillage of 85 tonnes of generator oil.

[cold weather, storage tanks]

Lessons

[None Reported]

5009 08 June 1990

Source : THE HOUSTON POST, 1990, 9 JUN.

Location : Harris County; Houston; Texas, USA

Injured : 8 **Dead :** 0

Abstract

A road transportation incident. A spill of 3000 gallons of hydrochloric acid occurred due to valve failure on a road tanker. Led to the evacuation of 75 - 100 people.

Lessons

[None Reported]

4988 18 May 1990

Source : THE SUN BALTIMORE, 1990, 19 MAY.

Location : White Plains, USA

Injured : 23 Dead : 0

Abstract

A road transportation incident. A road tanker spilled 50 gallons of corrosive material, hexamethylenediamine on road way due to broken pressure release valve.
[valve failure]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

Recirculation pumps tripped due to over-temperature.

A quantity (10-15 kgm) of diketene thus became trapped in pipework for a period of approximately 45 minutes.

The diketene decomposed thus building up pressure in the pipeline to a level at which a flange gasket failed and material was ejected under pressure from the failed joint.

Fortunately no one was injured in the incident.

[high temperature, decomposition, gasket failure]

Lessons

The report stated that following recommendations:

1. Various plant modifications aimed at preventing the accumulation of diketene in pipework and/or equipment.
 2. Review of operator training in response to pump trip-outs.
 3. Install alarms to indicate non-operation of the recirculation pumps.
 4. A wide range of procedural and operating improvements.
-

4964 22 April 1990

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

Location : Texas City; Texas, USA

Injured : 0 Dead : 0

Abstract

A river transportation incident. A river barge side cracked at a dock causing the spillage of 37,000 litres of diesel into a river.

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.

Source : ICHEME

Location : , AUSTRALIA

Injured : 0 Dead : 0

Abstract

A massive explosion occurred involving four large tanks of liquid fuel sending fireballs 200 m high. Thousands of residents within a two mile radius were evacuated and the international airport was closed immediately. Firefighters sought to control the blaze and keep it away from thousands of gallons of aviation fuel stored at the facility. Small fires were still burning in the area 12 hours after the explosion.

Possible causes are a faulty release valve allowing pressure to build up in one of the tanks causing an explosion rather than a burn-off or a faulty pump in a small storage tank which ignited the bigger tank and the fire rolled through the plant.

[fire - consequence, evacuation, storage tanks, valve failure

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]

4942 25 March 1990

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

Location : Los Angeles Harbour; California, USA

Injured : 0 **Dead** : 0

Abstract

A container holding approximately 5,000 gallons of acetonitrile was dropped from a crane during unloading from a container ship. A longitudinal support on the outside of the container broke, causing the container to fall approximately 30 feet onto a deck cover on the ship where it ruptured. It was estimated that 50 percent of the acetonitrile leaked from the container onto the deck, and into the hold of the ship, and into the water. The probable cause was a structural failure in a welded seam of the top rail of the frame of the container.

[material of construction failure, weld failure]

Lessons

[None Reported]

Source : LLOYDS LIST, 1990, 21 MAR.; HAZARDOUS CARGO BULLETIN, 1990, MAY; THE GUARDIAN, 1990, 21 MAR.; CATES A.T, FLUORAROMATICS EXPLOSION 20 MARCH 1990 ASSESSMENT OF THE EXPLOSION AND OF BLAST DAMAGE, JOURNAL OF HAZARDOUS MATERIAL 1992, 32, 1-39; MOONEY D.G, AN OVERVIEW OF THE SHELL FLUOROAROMATICS PLANT EXPLOSION, HAZARDS XI SYMPOSIUM, UMIST, MANCHESTER, 16-18 APRIL 1991, ICHME NORTH WESTERN BRANCH, 1991; LOSS PREVENTION BULLETIN, 100, 21-25.

Location : Stanlow; Cheshire, UK

Injured : 5 **Dead :** 1

Abstract

A runaway reaction caused vessel rupture and congested fire ball in a chloroaniline production unit. 95% of the plant was destroyed and debris was projected up to 300 meters away. The reactor vessel was used for the manufacture of 2,4-difluoronitrobenzene (DFNB) from 2,4-dichloronitrobenzene (DCNB) by reaction with potassium fluoride in the presence of dimethylacetamide (DMAC) as solvent.

The most likely description of events is as follows:

1. There was a runaway reaction in the reactor vessel, evolving some gas (almost certainly ketene and carbon dioxide), which caused the pressure to rise rapidly once the vessel approached its process temperature.
2. As the pressure rose, the safety valve blew. A flange (or similar) failed above the vessel and gave rise to a fire. The jet fire carried on burning for at least 30s before vessel failure.
3. The vessel burst, at a pressure of around 60-80 bar. The vessel fragments tore into two major and several minor fragments. The vessel fragments, and many surrounding pieces of plant work, were turned into energetic missiles, which flew up to 500 m away. The contents of the vessel did not denote.
4. As the vessel failed, the vessel contents continued to release energy, entrained air and rapidly ignited. The entrainment of air and combustion were greatly speeded up by the highly congested environment in which the vessel failure took place. The blast wind from this combustive event probably increased the number and severity of the missiles.
5. A large fire ball extending outside the structure occurred. A secondary fire started, which quickly involved the inventory of some nearby xylene storage vessels.

After the explosion, substantial amounts of acetic acid were found in various vessels and in the solvent recovered for recycling to the reactor. Laboratory-scale trials then showed that acetic acid would react vigorously with DCNB, heating the reaction mixture to about 240 degrees C, at this temperature a second exotherm started leading to an explosive decomposition. The problem facing the investigation was how did acetic acid come to be present in significant amounts?

They knew or had established the following:

1. Eighteen days before the explosion a holding tank for the reaction product and a filter had been washed out with water and some of the water passed through two leaking valves into the vessel in which the reaction product was stored before distillation.
2. Water reacts with DMAC forming acetic acid.
3. An azeotrope of DMAC and acetic acid has a similar boiling point to DMAC so it was recycled to the reactor with the recovered DMAC.

Water contamination had occurred before without causing any problems and any water present was normally removed at the start of the batch distillation. On this occasion there was so much water present that, unknown to the operators, it formed a separate, upper layer in the distillation column feed vessel. This layer was pumped into the distillation column during the later, high temperature stages of the distillation when the operators thought that all the water had been removed, acetic acid was formed, distilled off with the DMAC and recycled to the reactor.

[reaction vessel, fire - consequence, fatality, batch reaction, injury]

Lessons

1. All processes to be looked at again after a number of years to see if, in the light of new knowledge and new techniques, they present any hazards.
2. When a new process is being developed (or old one re-examined) all impurities which could plausibly be present should be identified.
3. Similarly, when a new process is being examined (or an old one re-examined) possible deviations from flowsheet conditions must be examined to see if they reduce safety margins, particularly the gap between operating and runaway temperatures.
4. Follow up unusual observation.
5. Any sudden change in pressure or temperature on a batch reactor will trigger an alarm.
6. Data that might be needed for investigation must be recorded in a way that will survive fire and explosions. The source of a problem may be far in distance or time from its effects.
7. Alternative processes are said to be uneconomic but perhaps they justify further study.

4912 01 March 1990

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

Location : New York Harbour, USA

Injured : 0 **Dead** : 0

Abstract

Hose coupling parted during barge unloading at a terminal. 18 200 litres of crude oil spilled.

[hose failure]

Lessons

[None Reported]

4904 22 February 1990

Source : NATIONAL TRANSPORTATION SAFETY BOARD, WASHINGTON D.C, USA, REPORT NUMBER NTSB PB-92-916402

Location : , PERSIAN GULF

Injured : 8 Dead : 2

Abstract

A marine transportation incident. Naphtha leaked from a tank into a ballast tank on a marine tanker and ignited. The leak arose due to a break in the weld but the source of ignition was not determined. Fatality.

[fire - consequence]

Lessons

[None Reported]

4871 30 January 1990

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 1ST QUARTER, 1990

Location : Ulsan, SOUTH KOREA

Injured : 0 Dead : 0

Abstract

An ethylene plant shutdown as a result of a leak of nitrogen from a storage tank due to valve failure.

[storage tanks]

Lessons

[None Reported]

4852 19 January 1990

Source : SEDGWICK LOSS CONTROL NEWSLETTER, FIRST QUARTER, 1990.

Location : Cadereyta, MEXICO

Injured : 0 **Dead** : 4

Abstract

A fire occurred in a storage tank probably caused by spark from welding torch. About 8 000 barrels of oil burnt. Fatality.

[fire - consequence, storage tanks]

Lessons

[None Reported]

4847 17 January 1990

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

Location : Fawley; Hampshire, UK

Injured : 0 **Dead** : 0

Abstract

Faulty gauge on a crude oil tanker during unloading caused leakage at tank pressure relief valve. A spill of 680 litres of oil occurred into a river.
[instrumentation failure]

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 : MARINE ACCIDENT INVESTIGATION BRANCH, SUMMARY OF INVESTIGATIONS, NO.2 1990.

Location : , UK

Injured : 0 Dead : 0

Abstract

During gas cleaning on a chemical marine tanker, a small fracture was detected in a bulkhead between the cargo tank and an adjacent cofferdam. The fracture was in a weld. The coffer dam was flushed out and the weld ground out and then welded. A small fire occurred in the cofferdam which was extinguished.

Due to construction of the vessel and restricted access to the cofferdam, it was difficult to mount a fire watch in that space. During welding operations in the adjacent cargo tank greater attention should have been paid to providing an alternative safe system of work.

As the previous cargo had been vinyl acetate monomer and liquid leaking from the cofferdam smelt of acetate, greater care should have been taken when educting the cofferdam to ensure that any residue liquid was only water.

Consideration should have been given to the fact that the cofferdams were painted and these coatings could catch fire from the heat generated by welding.

[welding, fire - consequence, weld failure]

Lessons

The following comments were made and procedures emphasised:

1. The importance of taking appropriate fire precautions during repairs.
 2. Procedure for entry into enclosed or confined spaces.
 3. The need for maintaining cofferdams in an empty and dry condition.
-

123911990

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

An incident occurred when sulphuric acid was pumped from a road tank car, using a flexible hose, flanged both sides.

The connection to the storage tank had been made some time ago, since the frequent unloading of H₂SO₄ tank cars and regarded as an almost routine operation.

To void spray of acid in case of a leakage, the flange connection had been covered by a lead slab. Shortly after discharging began, bolts in the permanent connection broke off, resulting in a sizable spray of sulphuric acid. Fortunately no one was seriously injured.

An investigation into the incident found that severely corroded bolts had caused the failure of the flanges connection. Using the lead slab as a cover had totally sealed the space between the flanges. The corrosive environment may have been created by a very small leakage of acid together with the humidity in the ambient air.

[material transfer, storage tanks, spill, material of construction failure, flange failure]

Lessons

[None Reported]

Source : ICHEME

Location : , USA

Injured : 5 Dead : 17

Abstract

An explosion occurred which caused significant equipment damage at a chemical plant.

The accident originated in a 90,000 gallon waste storage tank in the utilities area. The tank was demolished by the incident. The waste storage tank was designed to serve several purposes in processing waste water from a propylene oxide-styrene monomer (PO/SM) unit before disposal of the treated waste water into a deep disposal well on site. These purposes included:

1. Temporary storage of waste water.
2. Separation and temporary storage of light hydrocarbon liquids contained in the waste water.
3. Decomposition of light hydrocarbon peroxides produced in the PO/SM process and purged from the unit in the waste.
4. Separation of the resulting free oxygen and purging of the gaseous stream The tank was designed as an atmospheric pressure tank with dual conservation vents to relieve pressure buildup and to break any vacuum resulting from normal operation.

Because gaseous free oxygen was liberated in the tank from light peroxide decomposition, the tank was equipped with an inert nitrogen sweep system to purge the oxygen and maintain an oxygen concentration within safe limits. Due to the presence of light hydrocarbon liquids, the nitrogen sweep leaving the tank also contained hydrocarbon vapours. These hydrocarbon vapours were scrubbed from the tank vapour purge stream by a pressurised recovery tower located in the PO/SM Unit. A compressor was used to transfer the vapour purge stream from the atmospheric pressure tank to the pressurised recovery tower. A side stream from the compressor discharge was recirculated through the tank to ensure a uniform vapour composition.

The tank vapour space was sampled and analysed for oxygen content with a continuous readout in the control room.

The waste water treatment and handling design had been developed over a period of time from a series of technical studies, alternative evaluations, safety reviews, and HAZOP studies. It had operated safely and reliably for several years.

Investigation:

It was believed that the underlying reason for the explosion was an accumulation of oxygen in the vapour space of the tank, which was not detected because of an apparent failure in the oxygen analyser. The oxygen buildup was caused by a reduction in the nitrogen sweep rate, in fact for a period of 34 hours before the explosion, the nitrogen sweep was shut off completely.

Earlier that year the compressor had failed and was removed for repair. During the repair period, several modifications were made to the compressor's piping and instrumentation system to improve its reliability and performance. This action required the shutdown of the nitrogen sweep, and this occurred some 34 hours before the explosion.

Since the oxygen analyser continued to show an extremely low, and safe level, the nitrogen sweep was allowed to remain off, until just a few minutes before the explosion.

It is believed that only a very small amount of energy would have been needed to have ignited the tank vapour space, and that normal unit operations could have provided that energy source, in fact it could have been created by the compressor startup.

The resulting fire rapidly moved through the piping system to the tank vapour space, where the explosion occurred.

The investigation resulted in a number of actions and the cost of the safety enhancements and equipment upgrading is estimated to be \$20 million (1990).

Fatality.

[process analyser, instrumentation failure, fire - consequence]

Lessons

1. More fixed monitors to be installed and provision of portable water transfer pumps of the low head, self-priming high capacity type.
2. A review of work procedures, particularly when working on systems likely to cause deposition under valve seats or in drains.
3. Training and retraining on the properties of LPG and butane hydrate, symptoms of blockage, the Permit to Work System, isolation/handover of equipment, and general safety awareness.
4. There were also many aspects of Emergency Handling which needed to be improved.

Source : LLOYDS LIST, 1992, 23 MAY.

Location : Nepean, CANADA

Injured : 0 **Dead** : 0

Abstract

Transportation. A corroded pipeline 2 metres under the ground caused a spill of 11 to 16,000 litres of gasoline in a large pool about 8 metres below ground level. The company was fined.

[corrosion]

Lessons

[None Reported]

4819 1990

Source : OIL AND GAS JOURNAL, 1990, 18 JUN.

Location : Eden Prairie; Minnesota, USA

Injured : 0 **Dead** : 0

Abstract

Failure of a check valve and connected high pressure tubing caused spillage of 75000 gallons of diesel fuel from a pipeline into a river.
[valve failure, safety procedures inadequate]

Lessons

[None Reported]

Source : LLOYDS WEEKLY CASUALTY REPORTS

Location : St Maurice, CANADA

Injured : 0 **Dead :** 0

Abstract

35000 litres of polychlorinated biphenyls (PCBs) contaminated oil poured into a river. The leak occurred after a hydro transformer under repair was filled. Cold may have caused the transformer to crack. The spill led to a slick 4 km wide which spread 10 km. The leak occurred on the 24th but it was not noticed until the 8th Jan when the transformer was found empty.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A fire occurred at a refinery gas concentration plant. Equipment involved: furnace. Cause: tube failure.

[fire - consequence, refining]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Damage to a reactor at a petrochemical MTBE plant. Substance involved: catalyst. Cause: lining failure.
[damage to equipment, reactors and reaction equipment]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A fire occurred at a refinery reformer plant. Equipment involved: furnace. Cause: tube failure.

[fire - consequence, refining]

Lessons

[None Reported]

Source : ICHEME; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1990, APR.

Location : El Segundo; California, USA

Injured : 0 **Dead** : 0

Abstract

An explosion and fire shutdown a crude oil process unit at a refinery. Cause was seal failure on a pump.

[refining]

Lessons

[None Reported]

4745 16 October 1989

Source : DELAWARE COUNTY TIMES, 1989, 17 OCT.

Location : Upper Darby; Pennsylvania, USA

Injured : 0 Dead : 0

Abstract

A road transportation incident. 100 gallons leaked from pump seal of a road tanker of diesel oil. Spill.

[seal failure]

Lessons

[None Reported]

Source : P&J, SEP, 9, 1989.

Location : , UK

Injured : 0 Dead : 0

Abstract

A marine transportation incident. A marine tanker was approaching an estuary to offload 56,000 tonnes of crude oil when it collided with a tanker loaded with 46,500 tonnes of low sulphur fuel oil, at anchor. Fire's occurred on both ships after the collision and a fractured tank on the oil tanker caused a 20 mile oil spill by 7 miles oil slick.

Fire's on board both ships were contained within 3 hours six aircraft were used to spread oil dispersant to avoid onshore pollution.

[collision, fire - consequence]

Lessons

[None Reported]

Source : TELEGRAPH, SEPT 14, 1989.

Location : , UK

Injured : 0 Dead : 0

Abstract

Nine tonnes of aluminium sulphate leaked from a water storage tank, polluting a nearby stream. The chemicals entered the stream, a tributary of a nearby river, which provides drinking water for animals on a number of farms and runs through the grounds of a school.

The water tank had been out of action for a while and had not been checked for more than three months after being taken out of service, but was still kept full of the chemical.

It is not known how long the tank had taken to empty after an underground pipe was found to be fractured. The tank had been found empty during a check, after grey crusty deposits were discovered in the stream.

[storage tanks, pollution]

Lessons

[None Reported]

4706 12 September 1989

Source : LOSS PREVENTION BULLETIN, 094, 16; CHEMICAL WEEK, 1989, 20 SEP.; LLOYDS LIST, 1989, 20 SEP.; HAZARDOUS CARGO BULLETIN, 1989 OCT., 91.

Location : Morris; Illinois, USA

Injured : 18 **Dead** : 1

Abstract

A fire and explosion occurred in an ethylene cracker days before it was due to restart following another accident three months earlier. A blockage occurred in the acetylene heat exchanger, and a valve opened by mistake led to a release of ethylene. This cooled the heat exchanger down to a very low temperature and caused brittle fracture of the heat exchanger. The gas was then ignited. Fatality.

[fire - consequence, gas / vapour release, cracking]

Lessons

[None Reported]

4700 05 September 1989

Source : LOSS PREVENTION BULLETIN, 099, 3; SAN FRANCISCO CHRONICLE, 1989, 6 SEP.; LLOYDS LIST, 1989, 7 SEP.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, OCT.

Location : Martinez; California, USA

Injured : 2 **Dead** : 0

Abstract

An explosion or fire occurred in a hydrotreater unit which was processing FCC (Fluid Catalytic Cracking) feedstock. A failure occurred in a pipe downstream from a separator, resulting in the release of hydrogen and hydrocarbons in the unit area. The cause of line failure is unknown.

[cracking equipment, pipeline failure, unidentified cause, injury]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 098, 21-23.

Location : ,

Injured : 0 Dead : 0

Abstract

A major fire occurred in a stack of wooden pallets in the grounds of a warehouse. A main 132 kV double circuit supply line passed directly overhead. As flames and smoke engulfed the overhead lines, arcing occurred and supplies became erratic for about half an hour and then were totally lost for about 15 minutes before the re-establishment of a restricted supply.

[fire - consequence, power line, storage]

Lessons

[None Reported]

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

Location : Marcus Hook; Pennsylvania, USA

Injured : 0 **Dead** : 0

Abstract

A spill of 600 gallons of crude oil occurred at a terminal at the end of unloading operation due to failure to operate valve.

[valve failure]

Lessons

[None Reported]

Source : DAILY TELEGRAPH, AUG 21, 1989, AUG 22, 1989,; LLOYDS LIST 22/08/89, 23/08/89, 24/08/89 AND 25/08/89.

Location : , UK

Injured : 0 Dead : 0

Abstract

One hundred and fifty tonnes of crude oil escaped from a 12 inch pipeline under the river. The pipeline carried crude oil from the terminal to a refinery. The spill caused pollution and ecological damage along a 50 km stretch of the estuary, threatening the breeding grounds of tens of thousands of birds. The clean-up costs and likely damages payments were expected to reach about £1m (1989).

The company was criticised for delays in providing clean-up equipment. The leak was the third involving different pipelines in the estuary during the previous 3 years.

[transportation, pipeline failure, unidentified cause]

Lessons

An independent committee was set up to study the impact of the leak and identify lessons for future spillages.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Damage to a furnace due to tube failure at a petrochemical vinyl chloride plant.
[damage to equipment]

Lessons

[None Reported]

4679 13 August 1989

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A fire at a fertiliser plant. Equipment involved: furnace. Cause: tube failure.

[fire - consequence]

Lessons

[None Reported]

1013208 August 1989

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

Early on the 8th of August one of three power boilers was taken out of service to repair a safety valve that had failed in the open position. The resultant steam escape caused significant noise. A second boiler was shutdown on the same day following failure of the power supply to the boiler instrumentation. All plants were taken offline. The lack of steam caused smoke problems from flaring. 55 telephone complaints were received during the evening and night. Local media interest was high and a local Government representative insisted on a private meeting with the site management. On arrival with a camera crew the management requested a private meeting with the representative. Subsequent television coverage hinted at a cover-up. The plant was restarted 5 days after shutdown.

[shutdown, vent, flare system, power plant, plant shutdown, gas / vapour release, noise, power supply failure, valve failure]

Lessons

A 24 hour rota was set up to receive telephoned complaints, which were dealt with in a courteous manner and an apology and explanation give.

Proper and early contact was made with the relevant authorities.

The company placed an advert in the local paper explaining the situation and apologising to the local community.

4672 07 August 1989

Source : LLOYDS LIST, 1989, 9 AUG.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, SEP.

Location : Aspropyrgos, GREECE

Injured : 0 Dead : 0

Abstract

Transportation. A fire occurred at a pipeline running adjacent to one being repaired. Ignition was by a welding spark. Substance involved: hydrocarbons.
[fire - consequence]

Lessons

[None Reported]

4662 29 July 1989

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

Location : North Sea, NORWEGIAN SECTOR

Injured : 0 **Dead** : 0

Abstract

Pipe riser from well to offshore platform burst leaking 15 cubic metres of oil/gas mixture onto platform before it was isolated. Corrosion found.
[spill]

Lessons

[None Reported]

4645 16 July 1989

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

Location : South Portland; Maine, USA

Injured : 0 **Dead** : 0

Abstract

A rail transportation incident. A break in rail tankers' lining led to spillage of 200 gallons of hydrochloric acid in an urban railyard. Evacuation of 1000.
[lining failure]

Lessons

[None Reported]

4637 07 July 1989

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, AUG.; LLOYDS LIST, 1989, 10 JUL.

Location : Dartford Marshes; Kent, UK

Injured : 0 **Dead** : 0

Abstract

Transportation. Seal failure on a spur line gave rise to a spillage of 2 000 gallons of gasoline from a pipeline.

Lessons

[None Reported]

Source : ICHEME**Location :** Billingham, UK**Injured :** 5 **Dead :** 2**Abstract**

The casing of a high pressure ammonia injector (reciprocating liquid pumps) on a urea plant failed without warning, catastrophically. The release of 10 tonnes of liquid ammonia in three minutes resulted in the death of two employees who were working close to the injector (pumps). The D recycle pump had been recommissioned following maintenance at 1140 hrs that day. There were no unusual circumstances occurring except for a slight knocking noise on D recycle pump 15 to 30 minutes before the incident.. An operator and maintenance fitter went to look at the machine and were seen to be looking at the rods a few seconds before the incident. There was a bang from the compression building and a white out (dense fog of ammonia). The toxic alarm was sounded and the plant shut down. The workers in the control room donned 10 minute breathing apparatus and escaped the plant area. A major emergency was called. The 'D' ammonia injector reciprocating pump is one of five 3 cylinder positive displacement pumps driven at 192 rpm (increased from 135 rpm in 1969) by an electric motor through a speed reducing gearbox. The 'D' crankshaft had fractured allowing plungers to come out of the cylinders thus causing an uncontrolled release. All of the damage was judged to have been caused by the crankcase failure across the web between No. 1 and 2 crankpins. The fracture was due to a fatigue crack. Crack detection revealed two other defects.

[gas / vapour release, pump failure, fatality, operational activities, pressure raising/reducing equipment]

Lessons

The ammonia release could have been reduced or stopped earlier if:

1. The operators had been able to remain in the control room to perform the necessary actions.
2. In addition to the four ammonia suits/breathing apparatus sets additional equipment had been available for the process team to enable them to carry out isolations.
3. If ammonia supply to the plant had been isolated earlier by personnel responsible for the site ammonia distribution system. Any of these actions would have permitted earlier lifting of the site toxic alarm emergency system.

The root cause of the failure and hence the whole incident was the lack of appreciation that a failure in the 'motion work' of this machine could lead to a catastrophic release of the process fluid. In principle the initial design of the machine should have ensured that the plungers do not have come out of the cylinders in the event of a crankcase failure and loss of containment could have been minimised by process plant design. Neither was done because such failure was never envisaged. Had this actually been appreciated trip systems around the pump could have been installed which would have protected against massive loss of containment. What initiated the crack which then developed by fatigue is not clear but possible factors may be:

1. Cavitation of the pump.
2. The pump may have been required to pump carbamate.
3. Misassembly of the discharge valve cages.

4634 06 July 1989

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

Location : Pireus, GREECE

Injured : 4 Dead : 0

Abstract

An explosion occurred during marine tanker loading operation (allegedly due to pumproom leakage) followed by engine room short circuit. Substance: gasoline.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A leak occurred on a styrene residue line located on an elevated pipetrack between a substation and a power station. An investigation into the incident revealed that the leak had occurred due to a hole in the pipework which was caused by underlying corrosion.

A permit to repair the corroded line was issued and cold cutting operations took place, when styrene residue escaped the cut line. This caught fire at ground level, immediately beneath the pipetrack and rapidly spread upwards to engulf the working scaffolding platform and the pipetrack.

The two technicians carrying out the repair work on the working platform escaped and were uninjured.

The fire severely damaged the cable trays containing the main electrical supplies to the power station causing total loss of electrical power with consequent shutdown.

[fire - consequence, damage to equipment, plant shutdown]

Lessons

[None Reported]

4621 27 June 1989

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

Location : Dubai, UNITED ARAB EMIRATES

Injured : 0 **Dead** : 0

Abstract

Sparks from welding operation ignited residues in a marine tanker cargo tank. Substance: hydrocarbons.

[fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A flashover occurred between phases on a primary side of a transformer causing the main electrical system to collapse momentarily. The emergency generator was started and the emergency switchboard was isolated from the main supply, but this failed to automatically connect the generator to the emergency switchboard.

The instrument uninterrupted power supply (UPS), whose main supply is derived from this emergency switchboard continued to feed users from its battery source. Approximately fifty minutes later, with batteries fully discharged, the UPS attempted to revert unsuccessfully to its supply.

Temporarily interruption to the UPS output occurred, resulting in a large part of the refinery being shutdown. Consequent loss of product occurred.

The cause of the incident was a result of two separate failures:

1. Insulation failure of 15/5.5 KV transformer primary spouts.
2. Failure of instrument UPS system.

[plant shutdown

Lessons

[None Reported]

4596 04 June 1989

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

Location : , NORTH SEA

Injured : 0 Dead : 0

Abstract

Pipework corrosion forced closure of two offshore platforms. [oil]

Lessons

[None Reported]

4583 24 May 1989

Source : THE EVENING SUN BALTIMORE, 1989, 26 MAY.

Location : Havre De Grace; Baltimore, USA

Injured : 0 **Dead** : 0

Abstract

5000 gallons of gasoline leaked from an underground storage tank due to faulty overflow detector.

[instrumentation failure, spill]

Lessons

[None Reported]

4579 16 May 1989

Source : LLOYDS LIST, 1989, 8 JUN.;HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, AUG.

Location : Tampa; Florida, USA

Injured : 0 **Dead** : 0

Abstract

A storage tank gave way causing a spill of 132,000 gallons of phosphoric acid, of which some entered a waterway. Cause due to gaps in inner lining and metal shell corroding.

[corrosion]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

An explosion occurred in the firebox of a boiler at a power station after a series of earlier superheater tube failures in two the boilers. The explosion occurred while the boiler was being shutdown following a superheater tube failure. A concurrent failure in the burner control system caused a burner gas valve to remain open when it should have closed. This is thought to have been a major contributory factor leading to the explosion.

The cause of the superheater tube failure was caused by the installation of too much heat transfer capacity in the primary superheater section of the boiler, which has resulted in metal temperatures exceeding the design whilst on gas firing.

Lessons

Modified operating procedures have been recommended to prevent the possibilities of this reoccurring.

A design review is required to identify the modifications necessary to ensure safe long term operation of both the boilers at design conditions.

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, JUN.; LLOYDS WEEKLY CASUALTY REPORTS

Location : Trans Alaska Pipeline; Alaska, USA

Injured : 0 **Dead** : 0

Abstract

Transportation. A crack in pumping station forced reduction in oil flow through pipeline. Crack occurred in dead leg which did not have oil flow. Crack occurred where steel mill stamped its marking on pipe. This may have caused weakness. Throughput of 2 million bbls per day temporarily reduced by 25% for 3 days.

[pipeline failure]

Lessons

[None Reported]

4537 10 April 1989

Source : LOSS PREVENTION BULLETIN, 099, 3; HAZARDOUS CARGO BULLETIN, 1989, JUL., 81.; LLOYDS LIST, 1989, 13 APR.; SAN FRANCISCO CHRONICLE, 1989, 11 APR.

Location : Richmond; California, USA

Injured : 8 **Dead** : 7

Abstract

A 2-inch line carrying hydrogen gas at approximately 2,800 psi failed at a weld, resulting in a high pressure hydrogen fire. The fire resulted in flame impingement on the support of a 100-foot high reactor in a hydrocracker unit. The steel skirt for this reactor, which was 10 to 12 feet in diameter and had a wall thickness of 7 inches, subsequently failed. The collapse of this reactor damaged fin-fan coolers and other processing equipment, greatly increasing the size of the loss. It is believed that at the time of the loss, the hydrocracker unit was in the process of being shut down for maintenance. Therefore, the reactor was in a hydrogen purge cycle. The cause of the initial hydrogen leak is believed to have resulted from the failure of an elbow to reducer weld in the 2-inch hydrogen preheat exchanger bypass line. Fatality.

[weld failure, fire - consequence, damage to equipment, reactors and reaction equipment, shutdown, cracking]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

During the discharge of 3350 tonnes of molasses a failure of a fourteen inch carbon steel line occurred adjacent to a flood protection bank outside the site boundary fence.

It was estimated that 520 tonnes of molasses was lost and the cost of this and the ensuing recovery, disposal and investigation was calculated at approximately £35,000 (1989).

The molasses line was installed in 1941 for molasses receipt at a jetty. Since this time eleven sections were renewed in 1972 and six sections in 1980.

The vessel concerned berthed at the jetty at 20:40 hours on Tuesday 4th April. Hoses were connected at 21:50 hours and cargo sampling carried out.

Pumping from ship to shore commenced at 23:10 hours at an average overnight rate of 20 te/hr. The rate was low as the ship initially drew from its smallest tank via small lines. Rates were increased the following day to 90 te/hr received.

Ships discharging molasses were contractually obliged to achieve an overall rate of 135 te/hr. A letter of protest at the low rate was therefore issued. The molasses company surveyor was requested to attend a meeting to discuss the situation.

At this meeting notice was given that the ship may be requested to vacate the berth at 23:30 hours on Wednesday - the end of the permitted time period for discharge.

Later that afternoon the Bulk Cargo Shift Pumpsman discovered a line failure at 15:50 hours whilst closing the butanol tank valves. He informed his Supervisor who suspended the discharge operation immediately. It was clear at this point that the loss was great and the leak severe. Of the 520 tonnes of molasses lost approximately 300 tonnes was recovered in addition to a lesser quantity of contaminated water.

The leak occurred on an 80 ft long flanged section of line local to a pipe support. The mechanism of failure was thought to be localised external corrosion. The original line was approximately 50 years old and in poor condition.

The costs of the incident were as follows (1989 prices):

520 te molasses @ £55 te/r	28,600
2.5 demurrage on ship @ £2,000/day	105
Recovery and disposal costs	1,382
Redundant tank cleaning and disposal cost	4,000
100 man hours recovery and investigation	1,300
Total	£ 34,387

[material transfer, unloading, line, spill, pollution, product loss, corrosion]

Lessons

The company made a series of recommendations:

1. Operating Procedures must be modified to re-affirm the responsibilities of individuals for line patrols and their frequency.
2. Immediate de-vegetation of areas around this and other discharge, internal and export lines must be carried out.
3. Policy as regards the standard of lighting and paving alongside this and other remote transfer lines where operators are expected to patrol should be reviewed and improvements made.
4. Redundant lines must be removed from alongside this and other internal and export lines where these obstruct the view of live lines, making minor leaks difficult to sight.
5. A procedure for recording ship's discharge rates and comparing these with shore receipt figures must be formalised.
6. Individual Bulk Cargo operations staff involved must be interviewed by their line management where the importance of line patrolling is to be emphasised and further action taken as necessary.
7. The failed section of line must be replaced immediately.
8. The complete line must be subjected to a strength test and external inspection to 1.5 times the maximum operating pressure (100 psig). This only provides short term fitness for purpose with no guarantees against further failures.
9. The current restrictions of 100 psig discharge pressure at the ships pumps must be reinforced in writing by line management until the line integrity has been improved.

Source : LLOYDS WEEKLY CASUALTY REPORTS

Location : Victoria, AUSTRALIA

Injured : 0 **Dead** : 0

Abstract

Transportation. Weld on a 8 km long pipeline failed. 2,640 gallons of gasoline leaked from a 1 metre long crack.

[weld failure, spill]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, 1990, JAN.

Location : , OFF SPANISH COAST

Injured : 0 **Dead :** 4

Abstract

During entry into confined space, 4 men were asphyxiated by low oxygen level in the hold of a marine transport vessel carrying steel metal shavings. The low level of oxygen was caused by rusting of the metal shavings. Fatality.
[asphyxiation]

Lessons

[None Reported]

4518 27 March 1989

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

An ethylene oxide road tanker was overfilled due to a coincident failure of the preset tank loading meter and the local tank level indicator gauge. The tanker relief valve lifted blowing a small quantity of ethylene oxide to atmosphere.

[overflow, instrumentation failure, gas / vapour release]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A road transportation incident. A leaking tanker was reported by a motorist. The company was contacted by the police.

The company informed the police as to the destination and likely route of the tanker, which was carrying ether.

The company contacted the weigh bridge operator who had carried out a visual inspection of the tanker prior to commencement of the journey. He reported no evidence of leakage. The police contacted a radio station who broadcast a message to the tanker driver. The tanker was stopped and a leak was indeed found.

On inspection a small weld fault on the tank seam near the offside cleaning ring was observed. The weld was repaired and approved by a welding inspector.

The tank was part loaded with water and pressure tested. No further leaks were apparent. The repair was certified according to company procedures.

[road transport, road tanker, material of construction failure, weld failure, spill]

Lessons

[None Reported]

4508 22 March 1989

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Leak from a road tanker barrel was found when police stopped the vehicle. Split found in tank barrel adjacent to cleaning ring due to faulty weld. Diethyl ether on the tanker offloaded into another tanker.

[spill, weld failure]

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.
-

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

When 100 % acetic acid was pumped from the tank farm to a production building, 1600 litres of the acid leaked into the tank basin via the sight glass downstream of the pump.

Cause:

After removal of the insulation of the pipe it was found that the bolts of the sight glass were corroded.

[material transfer, corrosion, spill]

Lessons

The following recommendations were made:

1. Removal of the insulation of all flanges of this acid line, and replacement of all corroded bolts.
 2. Programmed inspection of all control connections (safety maintenance and control programme).
-

4475 22 February 1989

Source : NEW STRAITS TIMES, 1989, 23 FEB.

Location : Tangga Batu; Tanjung Kling; Malacca; Malasia, MALASIA

Injured : 5 **Dead :** 0

Abstract

880 kg of ammonia leaked when a rubber hose being used during loading of a road tanker burst.

[hose failure, gas / vapour release]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 109, 1-5.

Location : Kokkola, FINLAND

Injured : 0 Dead : 0

Abstract

An explosion occurred in the sulphonation compartment of an aminophenol-plant. The incident caused severe damage to the factory, but no workers were injured. Sulphonation of nitrobenzene with oleum was the first reaction step in the MAP-process used. The reaction was known to be highly exothermic and therefore considered the most hazardous one in the whole plant. Due to this fact several precautions were taken against "runaway-reactions", both during the planning of the whole compartment and also during the operation of the actual process.

The sulphonation batch No. 809 was just analysed and found OK. No un-reacted nitrobenzene was left in the reaction mixture. The transfer operation to the neutralisation reactor was done by using a submerged pump located in a tank in the sulphonation compartment. The first problem arose when the automatic system failed to open a valve in the transfer line between the sulphonation and neutralisation reactors. In order to transfer the batch to the neutralisation reactor, the foreman of the shift opened the valve manually, activating the transfer operation. The operation proceeded normally and the pump was shut off by the flow switch when the sulphonation reactor was empty. By inspection of the reactor the operators found that there were still a few litres left on the bottom of the reactor. Attempts were made to empty the reactor, but the pump could not transfer such a small amount of liquid. After this attempt the manually opened valve was closed by the foreman. The explosion took place 14 minutes later.

After the accident an investigation of the possible causes was initiated. It was known that a temperature-alarm from the pump-tank was activated soon after the termination transfer operation. The recorded temperature was abnormally high in the pump-tank which made it obvious that something had increased the temperature in a way that finally led to temperatures where the nitro group started to decompose. The investigation group was decided that the cause was an exothermic reaction between oleum and water. The exceptional transfer operation due to the control valve failure was suggested to be the main reason to the accident. The valve was jammed probably as a result of crystallisation of small amounts of sulphonation product in the control valve. The automation-system had to be bypassed and the valve had to be opened manually.

[exothermic reaction, reaction vessel, sulphuric acid, damage to equipment]

Lessons

The investigation of the accident revealed several surprising facts concerning the safety analysis of the process itself. The ultimate cause of the explosion was the thermal decomposition of the nitro-group in the molecule. It is a known fact that organic nitro-compounds are used in the manufacturing of explosives. This hazard was taken into account during the planning of the compartment for the exothermic sulphonation reaction. The safe operation was secured by multiple measurements of temperatures and pressures. One of the walls was built to release the pressure in case of an explosion. The nitro-group, however, was not given the deserved attention.

The oleum/sulphuric acid surplus in the reaction mixture was another chemical factor that contributed to the outcome of the event. The analysis of the actual batch showed a small excess of oleum and sulphuric acid in the reaction mixture. This was probably caused by a failure in dosing nitrobenzene due to a balance error. Although the dosing of reagents was slightly incorrect, the free oleum and sulphuric acid amount in a normal batch could easily liberate the thermal energy needed to raise the temperature to the critical range when reacting with water. As many times before the key to the "runaway reaction" was the harmless chemical H₂O. The amount of steam that passed backwards from the neutralisation reactor through the open valve to the pump-tank reacted gradually with the content of the tank raising the temperature to the critical range.

Soon after the transfer operation was complete there was an alarm from the pump-tank. The temperature had exceeded 120 degrees C, which was unusual but had happened before. The operators did not react to the alarm due to lack of knowledge. On the other hand, the pump-tank was missing an emergency draining system, which means that nothing could be done with immediate effect on the situation. The deviation that started the whole chain of events was the jammed control valve. The malfunction of the valve could probably have been prevented if a better isolation and/or a wiser location of the valve had been designed. After the transfer operation there was always a small amount of sulphonated material that crystallised on the valve when the temperature decreased. This fact was finally one of the main indirect causes to the explosion.

The above mentioned lack of knowledge, or human error, which contributed to the outcome of the event chain had already been identified during the safety analysis stage (HAZOP) of the process design. A possible backflow from the neutralisation reactor was never proposed as a deviation during the HAZOP-sessions. A check valve that would prevent backflow towards the sulphonation reactor, and the possibility of water entering the vessels was mentioned in the protocols from the HAZOP-sessions, but the importance of these two factors was not fully recognised.

A specific safety-subproject was initiated at the time when the planning of the whole plant started. Hazard evaluation of the sulphonation compartment was only one small part of the whole proposed hazard analysis program for the new factory. The huge work load of the HAZOP-group was thought to be a factor that had a detrimental effect on the outcome of the safety analysis. The members of the safety analysis team were not the same all the time, something which may influence the work of the group. The safety analysis sessions did not reveal the hidden hazard that in this case was considered to be just a pumping operation.

Highly automated processes are today relying not only on the software of the process computers, but also on the education and the skills of the operators. If a malfunction in the automation system appears in the process, the operators should be able to run the plant manually. A good understanding of the automation system should be the basis for conducting temporary procedures, when the process computer for one or another reason is off-line. The safety of a process is often dependent on the default valves and parameters in the process computer. These parameters are the result of several safety analysis sessions, where the optimal conditions concerning the safety and the yield of the processes, but sometimes it seems like a miracle when a near miss reveals a weak spot in the operation routine of an industrial process.

Source : ICHEME**Location :** , UK**Injured :** 1 **Dead :** 0**Abstract**

Three fitters were investigating the failure to start of a test engine. On assumption that the batteries were flat they applied the mobile charger across the terminals. A spark caused a local explosion. One fitter was temporarily deafened and the engine starter battery was written off. Total cost was estimated at £120 (1989).

The electrolyte level in the cells was low due to the repeated fast charge/discharge cycle. Hydrogen gas, which is evolved during the charging process, filled the cell's free space. When connecting the boost charger a spark was generated at the battery terminals. This being very close to a cell vent ignited the hydrogen. What was then experienced was a semi contained hydrogen explosion. The expansion within the battery case caused the vents to be blown off and the case to crack. The noise which temporarily deafened the fitter came from the "explosion" and cracking of the case.

[hydrogen, repair, battery, spark, damage to equipment, explosion]

Lessons

Battery units are high energy storage devices and consequently require caution when working on or around. Since batteries give off hydrogen, they must be installed in a well ventilated area. Personnel must avoid any possibility of generating electrical arcs or sparks in the vicinity of a battery.

Batteries contain acid or alkali electrolyte hence eye and hand protection must be adopted when handling.

Terminals on batteries are almost always exposed, thus potentially a hazard from short circuit.

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, MAR.; LLOYDS LIST, 1989, 2 FEB.

Location : Secunda, SOUTH AFRICA

Injured : 0 **Dead** : 12

Abstract

An explosion and fierce fire occurred at a synthetic fuels plant, allegedly caused by broken pipe. Corrosion of equipment was exacerbated by operating at 20% above design capacity. Maintenance stepped up and parts replaced by stainless steel. Cost estimated at \$170 m (1989). Fatality. Substance involved: gasoline.

[fire - consequence]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 129, 14.

Location : ,

Injured : 0 **Dead :** 0

Abstract

A fire occurred near a quench tower in the reactor area of this synthetic fuels plant. The main process equipment, such as the quench tower and associated heat exchangers, was not seriously damaged by the fire, however, the piping, instrumentation and electrical equipment in the process area experienced substantial damage. The tower skirts and pipe rack supports were protected by three to four hour rated fireproofing, which prevented the failure of these structures and limited the amount of property damage.

The fire resulted when a 6-inch carbon steel pipe, which is the return line of the recycle system for the quench tower that cools and separates the synthol reactor product stream, failed as a result of corrosion/erosion. Iron particles in the oil stream, subjected to a zone of turbulence, were a contributing factor in the pipe failure. The failure of the pipe caused a release of hydrocarbon product that spontaneously ignited under the high pressure and high temperature operating conditions.

[spontaneous combustion, fire - consequence, pipeline failure, processing, damage to equipment]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A short circuit at a power station led to a fire. Equipment involved: transformer.

[fire - consequence]

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 : 3 **Dead :** 1

Abstract

During maintenance work of the fire fighting system of a storage tank, the operation of which was due to change from styrene to benzene, an explosion occurred when an operator attempted to light a torch for welding flanges onto the cut foam pipes. The subsequent fire was quickly extinguished by application of suitable foam already available in the establishment. The tank was destroyed. Investigations revealed that maintenance was in progress though the tank had been filled with benzene and that the glass membrane of the foam chamber was missing, which allowed benzene vapour into the foam pipes. The work permit had been co-signed by the operation department though it was known that this maintenance work had to be performed on an empty tank. The maintenance department responsible for the execution of these works had not been informed that the tank was filled with benzene. Furthermore, benzene was stored in an atmospheric fixed roof tank without inert blanketing and there was no weak roof-to-shell seam.

[storage tanks, fire - consequence, spark]

Lessons

1. Compilation of written maintenance procedures; introduction of a quality assurance procedure for maintenance work, use of nitrogen blanketing in fixed roof tanks storing highly flammable liquids.
 2. Use of weak roof-to-shell seam.
 3. The last two points will become mandatory for critical atmospheric tanks.
-

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 : 5 **Dead :** 2

Abstract

Liquid ammonia was imported from the factory ring main to the ammonia injector installation of the urea unit through a surge drum, where it is mixed with recycled ammonia and where the pressure is boosted from about 21 bar (300 psi) to about 239 bar (3400 psi) by a conventional horizontal action-3 throw pump. The crankcase of this pump was punctured by fragments of the failed pump-ram crankshaft. The two operators investigating previously reported noises from the pump, were engulfed with ammonia and immediately surrounded by fumes.

Once the pump crankcase was broken, nothing could be done to prevent the release of the content of the surge drum (10 tonnes released in the first three minutes). The supply of ammonia from the ring main could only be stopped by switching off locally the supply pump. Thus, ammonia release continued.

Ammonia fumes quickly began to enter the plant control room and the operators hardly had the time to sound the alarms and start shutting down the plant before they had to leave the building using 10-minute escape breathing sets. The on-site emergency plan was activated within minutes after the alarm had sounded, a roll call quickly established that only two men were missing. Two gas-tight suits were used to search and rescue rather than to isolate the ammonia ring supply. The isolation of the main ring was achieved 40 minutes after the start of the release; in this lapse of time 28 tonnes of ammonia (in addition to the 10 tonnes initially released) escaped into the atmosphere.

The off-site emergency plan was activated within 5 minutes from the start of the release. Local radio warnings were given, but this was too late for some local schools, some mothers and children were affected while making their way home (the accident occurred at about 15.30h).

During the search and rescue operation, the fire authorities did not use gas-tight suits and fumes entered the gaps around the face piece and caused injuries to 5 men.

From the effects described and from post-accident modelling, it was likely that the ammonia concentrations were of the order of 150 ppm for 10 minutes at 3 km, dropping to 50 ppm for 15 minutes at about 7 km. A substantial number of people complained about the fume (up to 7 km away), but nobody was seriously affected. Fatality.

[drums, pump failure, safety procedures inadequate, design inadequate, processing, injury]

Lessons

1. Existing similar pumps will be thoroughly examined and fitted with crankshaft deflection devices.
 2. Critical plant machinery will be identified and subjected to a regime of inspections similar to that applied to pressure vessels.
 3. Automatic remotely operated shut-off valves will be fitted to liquid ammonia supply systems so that a hazardous piece of the plant can be isolated quickly.
-

Source : ENVIRONMENTAL PROTECTION BULLETIN, 005, 27-28. 1990.

Location : ,

Injured : 0 Dead : 0

Abstract

Pig farm incident. Effluent from the pigs ran into tanks and was then transferred into a lagoon constructed by digging an oblong hole in the ground surrounded by earthworks. Unbeknown to the farmers, a fissure two feet deep had developed in the side of the lagoon.

Rain which fell on the buildings contained the pig unit discharge through a which had become blocked by debris. Water bubbled up from the manhole and flowed downhill into the lagoon. When that filled up to the level of the fissure it overflowed and caused the pollution of a ditch and subsequent stream.

The farmers did not know rainwater was flowing into the lagoon, nor that it was overflowing. They were charged by the water authority with causing polluted matter to enter the stream.

[crack]

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).
-

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 a short circuit in one of the switch cupboards (25 kV), a fire occurred involving 3/4 of the plant's electric station and 10 switch cupboards. This resulted in the automatic shutdown of the chlorine production plant (except of the chlorine destruction unit) and the hexachloro benzene (HCB) production due to lack of adequate cooling capacity. The chlorine production facility remained 10 days off stream while the HCB production was resumed with imported chlorine. Gradual carbon formation in the mineral oil is suspected to be the cause of the short circuit.

[electrical, power supply failure, design inadequate]

Lessons

1. Installation of an inert gas-filled switch-cupboard instead of the oil-filled type.
 2. Installation of the new switch cupboard in separate compartments using a fire-resistant partition.
-

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 : 5 **Dead :** 0

Abstract

Ethylene oxide leaked through a hair-crack in a weld on a distillation column and contaminated the rock-wool insulation of a level indicator. Then it reacted with moisture to form non-volatile polyethylene glycols (PEG). On the day of the explosion, the metal covering of the insulation was removed so that the level indicator could be repaired. Air leaked in the insulation causing the decomposition of PEG and initiating auto-oxidation. The heat flux to the stagnant liquid of the level instrument stand pipe caused the ethylene oxide to autodecompose, which then passed into the distillation column causing a confined vapour explosion. The column was torn off and the escaping gas caught fire, leading to an explosion of a second column. 5 employees were injured and material damage amounted to about 0.05 MECU.

[weld failure, fire - consequence, damage to equipment, polyethylene glycols, liquid liquid separation, distillation, injury]

Lessons

1. Flanges must not be insulated. Insulation material must be checked on a possible reaction with EO. Use of proper gaskets for flanges.
 2. All pipework and pieces of equipment that may contain rust must be cleaned and inspected before restart of the installation.
-

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 : 0 Dead : 0

Abstract

A FCCU at a refinery was shut down for a regularly scheduled 4-year maintenance turnaround. The work was completed on schedule, and no significant or unanticipated problems were encountered. During the start-up and within hours of introduction of feed (regenerator at 1130 degrees F and reactor at 700 degrees F), however, an operator noticed vapour coming from the insulation around the reactor vapour line support hanger. Closer inspection revealed that this vapour was flue gas, apparently leaking from the line.

The start-up was put on hold for closer inspection, and it was found that vapour line immediately behind the horizontal support of the hanger had a crack through the wall. It was further assessed that this was a major crack which would require terminating the start-up and shutting down of the unit to make a thorough (internal) inspection of the line.

Although the metallurgical experts feel that there would probably not have been a catastrophic failure had the unit been started up without repairing the crack, there definitely would have been a leak and likely, also, a fire.

[gas / vapour release]

Lessons

The following recommendations were made:

1. Verify that insulation on high temperature system is adequate and is maintained.
 2. Prevent rain or other liquids from hitting directly onto hot equipment, which can cause thermal cracking.
-

Source : ICHEME

Location : , IRELAND

Injured : 0 Dead : 0

Abstract

An explosion occurred when effluent system water was injected into a syngas mixture (hydrogen/carbon monoxide/carbon dioxide/nitrogen) to cool the gas. The water injection nozzle was intended to inject water directly into the gas stream. Following the explosion the nozzle was found to be bent at 45 degrees. It was believed that this did not occur during the explosion, but two years previously during routine maintenance, when a crane incident occurred during nozzle re-installation.

Consequently the water stream injected directly onto the inner pipe wall rather than into the gas stream, causing stress corrosion and pipe rupture.

An approximate five metre rupture opened up on a seamless weld downstream of the injection nozzle which is believed to have been due to carbonic acid corrosion.

[cooling, maintenance inadequate]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 1 Dead : 0

Abstract

A rail transport incident. Whilst disconnecting the loading arm after completion of a railcar filling operation about 250 kg of propylene were released to atmosphere due to a valve operating sequence error. Fortunately the release was not ignited and an operator sustained only minor injuries.

The causes which contributed to the release of propylene were listed as follows:

1. Failure of the manual block valve/flare vent system to depressurise the loading arm filling line.
2. Failure of operators to follow standing instructions i.e. failure to use loading arm check valves to confirm depressurisation.
3. Block/vent valves operated a second time with flange still unbolted.
4. Time pressure. Faced with a very high loading frequency two men employed for an operation normally done routinely by one man. However this introduced communication/co-ordination problems and reduced the time allowed to vent the filling line.
5. The second operating error (i.e. operating the block valve with the flange still unbolted) occurred when the operator was perhaps still unsettled by the initial release of gas).

[gas / vapour release, valve failure, operator error, injury]

Lessons

1. On-the-job training should stress the importance of following the standing procedures.
 2. The incident also illustrates the importance of communications/planning at all levels in ensuring safe operation.
 3. When evaluating process changes the effect of changing the elapsed time between sequential operations needs to be considered; such deviations also need to be included in HAZOP studies of sequential/batch operations.
-

4375 06 December 1988

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

Location : Hull, UK

Injured : 0 Dead : 0

Abstract

Small electric spark ignited acetone in factory storing large quantities of acrylic resin.

[storage, fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : , HOLLAND

Injured : 0 Dead : 0

Abstract

A 3 inch carbon steel relief valve inlet line on an alkylation unit re-run tower broke away due to complete failure of a weld on the line due to corrosion.

Early activation of the sprinkler facilities and a number of firewater monitors enabled the HF (hydrogen fluoride/hydrofluoric acid) cloud to be contained to a small area, no injuries were reported, and operators wearing 'D' suits were able to locate and isolate the source of the release.

The weld in question had previously developed a pin hole leak and a temporary repair had been made 7 months previously by a specialist contractor. This repair consisted of an enclosure filled with a sealing compound and held in position by a 3mm thick holding ring located within the flange joint between the vent pipe and the tower nozzle.

The immediate cause of the (hydrogen fluoride/hydrofluoric acid) release was the failure of the repair enclosure holding ring. This allowed the enclosure to slip back and hence the pipe to break away at the failed weld joint.

The cause of the failure of the holding ring to withstand the shear stress arising from the force of the vessel internal pressure (normally 9-9.5 barg) when the weld failed is not known.

The cause of the failure was put down to five dangerous occurrences:

1. The initial pin hole failure of the weld.
2. Blockage of both on-line relief valves with solid polymer.
3. Multiple failures of tower level indicator.
4. Trip failure.
5. Failure of repair enclosure.

[weld failure, gas / vapour release]

Lessons

1. All clamps and enclosures for temporary repairs should be removed and replaced with new line pieces, valves, etc.
2. Weld inspections should be carried out.
3. All safety valves should be tested and the lines leading to these valves should be checked for blockages.
4. Review the adequacy of the existing programme to check for internal corrosion in small bore and 'dead end' pipe work.
5. Review the policy of applying clamps and enclosures and the use of sealing compound injection for temporary repairs.
6. The construction of clamps should be reviewed and improved if necessary. A strict procedure should be developed for installation of the clamps.
7. If a leak develops or serious internal corrosion is found in a horizontal section of 'dead end' pipe, then the repair should include sloping the line to prevent the accumulation of acid scale/debris.

Source : CLAYTON W E, GRIFFIN M L, CATASTROPHIC FAILURE OF A LIQUID CARBON DIOXIDE STORAGE VESSEL, AICHE 28TH LOSS PREVENTION SYMPOSIUM, ATLANTA, 21 APRIL 1994,; LOSS PREVENTION BULLETIN, 125, 3-10.

Location : Worms; Frankfurt, GERMANY

Injured : 10 **Dead :** 3

Abstract

A catastrophic failure of a liquid carbon dioxide storage vessel in a citrus process caused 3 fatalities and \$20 million (1988) in property damage. An investigation showed that the vessel had been overpressured due to ice formation in the safety relief valve and heater failure in the heating on mode. A list of other carbon dioxide vessel ruptures is given. Fatality.

[safety relief valve failure, overpressurisation, storage tanks, mechanical equipment failure, vessel failure, damage to equipment]

Lessons

1. Elimination of the use of carbon dioxide in many non-critical applications.
 2. Leased or rented equipment must be to the same standard of safety as owned equipment.
 3. Carbon dioxide storage tanks should not be heated with an internal heater.
 4. Development and adoption of specific company design requirements for liquid carbon dioxide storage systems into standard practice.
-

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Leak of diesel from a storage tank at a terminal. Cause: brittle fracture.

[storage tanks]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A section of pipework failed during normal ethylene plant operations. A significant loss of gas/caustic soda occurred to atmosphere from a two-inch pipe at about 200 psig for several minutes. The plant was shut down.

Metallurgical examination of the failed section of pipe indicated a stress fracture of a weld flange, due to vibration, the result of inadequate pipe support. A further investigation of the incident is underway.

[pipeline failure, gas / vapour release, plant shutdown, normal operations, excessive vibration]

Lessons

[None Reported]

Source : ICHEME

Location : Los Angeles, USA

Injured : 0 Dead : 0

Abstract

A hot residue line in a piperack ruptured at a refinery. Failure of the line occurred under normal operating conditions, i.e. no flow in the line. Investigation in the condition of the pipe showed that the failure was due to internal thinning from hot sulphidation. The corrosion was centred mainly at the top of the pipe, with a thickness at the top of 0.004 inches at the failure and a thickness of 0.338 inches at the bottom.

The normal thickness for this pipe is 0.432 inches.

[normal operations]

Lessons

The report stated the following conclusions:

1. In lines with a material specification break to a lower grade, corrosion may occur in horizontal runs.
 2. Corrosion can occur in inactive lines some distance from their connection to stimulate flow.
 3. Vertical piping in a stagnant line seems to act as a thermosyphon to stimulate flow.
 4. It may be desirable to place block valves at material specification breaks.
-

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A gas / vapour release occurred during the normal operation of a caustic soda scrubber on the cracked gas from an ethylene plant. The release occurred at a joint failure in the weld between a flange and pipework. This was attributed to stress caused by excessive vibration as a result of inadequate pipe support.

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN 099, 4, AN APPLICATION OF FIRE SCIENCE TO AN INDUSTRIAL INCIDENT.

Location : , SINGAPORE

Injured : 0 **Dead :** 0

Abstract

An incident involved three floating roof tanks containing a total of 294,500 barrels of naphtha.

The three naphtha storage tanks shared a common bunded (dyked) area. Each tank had a diameter of 41 metres with a shell height of 20 metres. The tanks were spaced at 21 metres.

On the morning of 25th October, Tank A was receiving sour straight run naphtha when the floating roof was found partially submerged. Filling of the tank was stopped and for 2 hours product was transferred out of the tank however, this too was stopped when it was noted that the anti-rotational pole showing above the tank shell was physically displaced. The Refinery Fire Service then began to apply foam through the tank's fixed foam pourers but after 10 minutes ignition occurred resulting in an immediate full surface fire. Two hours later, the adjacent Tank B caught fire in the rim seal area and within a further 2 hours became totally involved. The third Tank C became fully involved at midnight the same day.

The fire was contained within the primary bund by cooling adjacent exposed tankage and the naphtha tanks were allowed to burn out, pumping out as much product as possible. The fire took five days to burn out.

The enquiry team set up to investigate the incident concluded that the floating roof sank due to a combination of flooded roof pontoons, heavy local rainfall and a partially choked drain. The most likely cause of the ignition was a frictional spark due to mechanical failure of the support for the anti-rotational pole where it was attached to the rim of the tank shell as a consequence of the sinking of the roof tank. The enquiry team also commented that the risk of ignition would have been significantly reduced if the foam had been applied earlier and the tank levels had remained stationary. A paper published in Singapore (Howells, Peter "Electrostatic Hazards of Foam Blanketing Operations" Butterworth Heineman February 1993) suggest that such a foaming operation can create a source of ignition through the Dorn Effect. (see also IChemE Loss Prevention Bulletin No. 138 "The LASTFIRE Project" Dec 1997.

[floating roof failure, fire - consequence, weather effects]

Lessons

In the event of this type of incident occurring again it is vital that:

1. Movement of oil into or out of the tank should be stopped immediately.
2. The exposed surface of the oil should be promptly covered in foam.
3. Although there is the risk of the tank contents emptying into the bund should the drain hose or articulated leg fail - on balance it is preferable that drain valves should normally be left open. The only exceptions to this would be in extremely arid climates where rain is a rare occurrence, and in this case there should be a standing procedure for the valves to be opened to cope with the rain when it occurs.
4. Determine the extent of the hazardous environment using gas measuring instruments. Remove/prevent any sources of ignition in this area and prohibit access by personnel.
5. Set up the resources as stipulated in the pre-fire plan in readiness in case of a fully involved fire.
6. Do not foam unless:
 - It is necessary to protect personnel from fire or flash burns if ignition were to occur during the restoration of the floating roof or removal of the product from the tank.
 - The tank contains crude oil (no static discharge risk).
7. Because of the potential for a static discharge ignition during the application of foam, the following information is provided for guidance based on initial research on this matter (IChemE Loss Prevention Bulletin No. 138 "The LASTFIRE Project" Dec 1997). When foam is to be applied:
 - Wherever possible utilise fixed foam pourers to apply the foam gently down the inside surface of the tank.
 - Once the foam has been applied, a total surface covering should be maintained at all times until the product has been removed.
 - Foam applied by hand lines or monitors must be applied onto the inside surface of the tank and allowed to slide down the inside of the tank wall onto the surface of the fuel. In no circumstances, should the foam/water mix be applied directly onto the surface of the unignited fuel as this could be the prime cause of fire caused by electrostatic generation.
 - Wherever possible the use of portable foam inductors which induce foam compound into the delivery hose using the venturi principle should be avoided. Foam production should be by means of fire pumps having built-in inductors or round the pump proportioners.
 - If portable inductors are the only type available, full foam throughput should be established with the water jet directed away from the tank. Only then should be foam applied to the tank as noted above.
 - Following application of foam onto a tank fire, which appears to have been successively extinguished, vigilance should be maintained until the remaining product has been removed. There remains a possibility that the foam blanket in breaking down through a depth of product may cause an electrostatic charge to be generated sufficient to cause reignition of any vapours present. A minimum of 2 to 3 metres of product depth is required before this is a problem.

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

When the battery was lifted from an forklift truck, some metal parts of the lifting tackle made contact with the non insulated metal bridges of the battery. This caused a short circuit with sparking and development of smoke.

[damage to equipment]

Lessons

Change to a newer type of battery, with covered poles and bridges.

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

A fire occurred on a production well. Source of ignition was spark. Substances involved: crude oil and gas.

[fire - consequence]

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.
-

4270 September 1988

Source : LLOYDS WEEKLY CASUALTY REPORTS

Location : Corby, UK

Injured : 0 Dead : 0

Abstract

A fire occurred in a crisp cooking room caused when oil valve failed during night shift. All 250 staff evacuated. Factory destroyed. Cost estimated at £50 million (1988).

[valve failure, fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 2 Dead : 0

Abstract

Two employees were splashed by hot dimethyl isophthalate after a vessel sight glass in the plant treatment area cracked and were treated for burns. Both men wore safety glasses which prevented more serious injury. All three emergency services were quickly in attendance and the plant temporarily shutdown.

Possible causes include:

1. Inherent susceptibility of a gauge glass in this location - a glass fractured in a sightglass in this position in 1985 which was caused by stressing due to overtightening.
2. Earlier in the month, the sightglass was found to be leaking and the inner gaskets were replaced. The glass and/or sightglass may have been damaged at this time.
3. The sightglass was rated for 150 psig. It seems unlikely that non-shock pressure in excess of the rated pressure could have occurred. However, the possibility of 'hammer' occurring when the valve on the line to the filter inlet was opened was investigated.

[processing, plant shutdown, damage to equipment, injury]

Lessons

The following recommendations were made:

1. Removal of the damaged sightglass and blanking off the resulting open ends, a test to determine the rise in pressure caused by thermal expansion should be carried out, material should be blown from pipework and the filter into the vessel, material should be transferred to a stainless steel stoolpiece used to replace the sightglass.
 2. The following items should be inspected: the pressure regulator, relief valve and non-return valve on the air supply to the line below the sightglass, the pump non-return valve and the vessel should be inspected for signs of debris.
 3. The need for sightglasses in this system should be re-examined. The possible causes of failure should be further investigated and discussions held with suppliers and company specialists. Recommendations should then be made as to whether and under what conditions sightglasses may be used. Prior to this being done, the system should only be put back into service if both sightglasses (i.e. below the vessel and on the filter outlet line) are replaced with stainless steel spoolpieces.
-

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A fire occurred at a petrochemical vinyl chloride plant. Equipment involved: furnace. Cause: tube failure.
[fire - consequence]

Lessons

[None Reported]

4240 28 July 1988

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Damage to a refinery Fluid Catalytic Cracker Unit (FCCU) plant. Equipment involved: pipework. Cause: refractory failure.
[damage to equipment, fluid cracker]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN 101, 1-2; SAFE USE OF CHEMICAL ADDITIVES, ICHEME, SAFETY TRAINING PACKAGE, 018, 3.6.**Location** : Houston; Texas, USA**Injured** : 0 **Dead** : 0**Abstract**

A rail transportation incident. A stainless steel rail tanker carrying acid-washed methacrylic acid was in a plant siding when it was noticed that a pressure-relief valve was lifting. The area was secured and a remote fire monitor was set up to knock down the vapours. Several hours later the relief valve stopped lifting. An explosion of the tanker occurred approximately 20 hours after this incident. This was one of five tankers filled with acid-washed methacrylic acid. Previously this substance was loaded into tank cars lined with a phenolic resin material and this was the first time stainless steel had been used. The most likely cause was polymerisation of the methacrylic acid and failure of the relief valve on the tanker due to it being blocked with polymer. The polymerisation was caused by a combination of iron contamination from corrosion of the stainless steel by the lower acid layer normally present in acid-washed methacrylic acid and the hydroquinone inhibitor level being lower than the target specified for shipment.

[safety relief valve failure, incorrect material of construction, lack of stabiliser/inhibitor, modification procedures inadequate]

Lessons

The following recommendations were made:

1. The rail tankers normally used were coated with phenolic resin, this was the first time that a stainless tanker had been used.
2. The modification to the process should have been assessed to establish whether there was any hazard involved in the use of the stainless steel. In this case there was a hazard which had not been identified.

1270520 July 1988

Source : FPA CASEBOOK OF FIRES.

Location : Co Durham, UK

Injured : 0 **Dead** : 0

Abstract

A fire occurred at a factory that manufactures wood pulp and wadding used in disposable nappies.

The factory structure and its contents were virtually destroyed by the fire and collapsed.

It is thought that the most likely cause was due to a spark, which may have occurred from a pulverizing machine, igniting hopper contents.

[fire - consequence, damage to equipment, product loss]

Lessons

[None Reported]

4231 18 July 1988

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A fire occurred at an ammonia plant. The cause was a seal failure on a compressor.

[fire - consequence, processing]

Lessons

[None Reported]

4222 11 July 1988

Source : LLOYDS WEEKLY CASUALTY REPORTS; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, SEP.

Location : Brisbane, AUSTRALIA

Injured : 0 **Dead** : 0

Abstract

A 3000 cub m (cubic metre) storage tank of gasoline ruptured at a depot giving rise to massive spill. Evacuation of thousands, electricity cut off. The tank was inspected by company 10 days earlier. Later inspection found the tank to be rusty and corroded and should not have been licensed for motor fuel.
[rusting]

Lessons

[None Reported]

Source : HOUSTON CHRONICLE, 1989, 24, OCT.; LOSS PREVENTION BULLETIN, 099, 13

Location : Port Arthur; Texas, USA

Injured : 0 Dead : 0

Abstract

A catastrophic failure of a 6-inch propane line and ignition of the resulting vapour cloud at a refinery tank pump station led to the subsequent failure of numerous other pipelines in the 50-foot-wide pipe trench. The intense fire quickly involved four 18,000 barrel, internal floating roof blending tanks containing raffinate, debutanised aromatic concentrate, and slop. Three of the tanks were lined up to piping in the trench and there was difficulty isolating the tanks and pipelines. Two empty spheroids were heavily exposed. The fire spread throughout the trench, and was extinguished 20 hours later.

[pipeline failure, fire - consequence, isolation inadequate, refining, floating roof tank, metal fatigue, vapour cloud explosion]

Lessons

[None Reported]

4180 04 June 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, JUL/AUG.; THE BALTIMORE SUN, 1988, 5 JUN.

Location : Milwaukee; Michigan, USA

Injured : 0 **Dead** : 0

Abstract

Transportation. An underground steel fuel oil pipeline burst spilling 128000 gallons into waterway.

[pipeline failure]

Lessons

[None Reported]

4172 24 May 1988

Source : THE TIMES, 1988, 26 MAY.; THE EVENING SUN BALTIMORE, 1988, 25 MAY.

Location : Chihuahua, MEXICO

Injured : 1 **Dead** : 0

Abstract

A fire occurred after an explosion at storage depot. 150 000 people evacuated. Fire started when electric short circuit ignited leaking gas from a tank. Fire confined to one tank which contained 1.2 million gallons of oil.

[gasoline, fire - consequence, evacuation]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A cracked gas compressor casing drain valve joint failed, releasing gasoline cracked gas at high pressure, and causing a gas cloud inside the compressor house. The compressor was tripped and the emergency successfully handled by the shift team. There were no injuries to personnel, nor damage to equipment.

The compressor had been returned to service following overhaul, subjected to static pressure test, and held at low speed for a number of days. The cracked gas system was set up in parallel to the operating machine 24 hours before the incident, for which there was no immediately apparent process cause.

[joint failure, gas / vapour release]

Lessons

Investigations showed that:

1. An incorrect gasket had been used.
2. Several other flanges were to the wrong standard.
3. The overhaul was done by contractors.

An enquiry team was set up to consider the wider implications of the control of contractors and of quality control.

Source : LOSS PREVENTION BULLETIN, 099, 4; EUROPEAN CHEMICAL NEWS, 1988, 16 MAY.**Location** : Louisiana, USA**Injured** : 70 **Dead** : 7**Abstract**

Operations were normal in a 90,000 barrels-per-day fluid catalytic cracking (FCC) unit when internal corrosion caused the failure of the outside radius of an 8-inch carbon steel elbow located 50 feet above ground in the depropaniser column overhead piping system. An estimated 20,000 pounds of propane escaped through the resulting hole, forming a large vapour cloud during the 30 seconds between failure and ignition. Both the depropaniser column and the accumulator depressured through the opening. Ignition of the vapour cloud probably was caused by the FCC charge heater. The initial blast destroyed the FCC control building and toppled the 26-foot-diameter main fractionator from its 15-foot-high concrete pedestal. The column separated from its 10-foot-high skirt before falling. Analysis of bolt stretching of towers in the blast path indicated over-pressures as high as 10 psi. The refinery immediately lost all utilities, including fire water and the four diesel pumps, greatly limiting the fire fighting effort for several hours. Steam pressure dropped abruptly due to severed lines. Twenty major line or vessel failures occurred in the FCC and elsewhere throughout the refinery. Blast damage throughout the plant was extensive, but was most severe in the 300-foot by 600-foot FCC unit.

A preliminary report stated that the failed elbow was located downstream of the injection point where ammoniated water was added to reduce depropaniser condensation or fouling. The elbow was a designated inspection point in the overhead piping system for taking ultrasonic thickness measurements during turnarounds. These inspections had constantly shown the expected corrosion rates of 0.05 miles per year. Measurements taken at the failed elbow and in the downstream piping after the explosion revealed unexpected high localised corrosion rates.

[fatality, fluid cracker, elbow failure]

Lessons

1. Perform thorough corrosion review as a base case, and update review when operating changes are instituted.
2. Utilize well designed injection systems to avoid corrosion failures; i.e., one with a flanged quill and atomizer to finely distribute the injected product to aid in mixing and to avoid slugging.
3. Monitor not only injection points, but also tees where two streams of potentially different compositions/temperatures join.

4150 23 April 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, JUN.; OIL SPILL CONFERENCE, SAN ANTONIO, TEXAS, 1989.

Location : Martinez; California, USA

Injured : 0 **Dead** : 0

Abstract

432,000 gallons of crude oil spilt from a refinery into a bay. 150 acres of wetland wildlife sanctuary and 11 miles of shoreline affected. A storm drain hose inside an oil tank broke and company left storm drain open.

[hose failure, environmental, refining, drains & sewers]

Lessons

[None Reported]

9988 15 April 1988

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

As a result of a safety relief valve failure during the start-up/ commissioning of a second naphtha cracking furnace, "cracked gas condensate" (light hydrocarbons) was able reverse flow through the overpressure relief system, and leak out through an expansion joint. The leaking liquid spilled over a furnace and was ignited. The fire consequences were substantial, involving plant shutdown and major damage to equipment. Although the main fire was extinguished after about 20 minutes, several smaller fires ensued and it was about 1 hour before they were under control. There were no injuries.

[fire - consequence, training inadequate]

Lessons

An inquiry team reported that reverse flow through the relief valves was well known, as there had been a previous incident. The reason why four methods for detecting this relief valve leak had not been carried out was attributed to training inadequate. The procedures were to be revised.

4084 20 January 1988

Source : ICHEME

Location : , HUNGARY

Injured : 0 Dead : 0

Abstract

Transportation. A pipeline carrying crude oil sprang a leak causing a spill of 300 tonnes. The origin of the crack is not known.

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 106, 15-16.

Location : , USA

Injured : 0 Dead : 0

Abstract

A 96,000 bbl (36m x 15m diameter) storage tank collapsed releasing 14800 m³ of diesel fuel. The destroyed tank caused widespread damage and pollution of a nearby river. Municipal water supplies in the area had to be diverted for a number of weeks with attendant disruptions. Although recovery and containment procedures were immediately instituted, 1930 m³ of product still was unrecovered. The tank had previously been removed from another site. After investigation it was stated that the tank failure had been due to a brittle failure, initiated at a flaw in the tank shell base metal, approximately 20 cm up from the bottom. The flaw had been created by an oxy-acetylene cutting torch in the original shell when it had been first fabricated. The region of the flaw suffered embrittlement, a reduction in fracture initiation resistance, as a result of the nearby old and new welding. The instantaneous fracture in the shell which developed had crossed welds but did not follow them. The quality of the welding therefore did not cause or contribute to the failure.

Lessons

Before dismantling vertical welded tanks for re-use at a different location, adequate guidance should be provided regarding the engineering standards which should be met for:

1. Tank dismantling.
2. Transport of components to the new location.
3. Tank reconstruction at the new location.

Bearing in mind the above, the essential points which should be addressed include:

1. Establishing the properties of the shell steel of the tank to be moved by testing if necessary.
2. Whether the relevant tank in its new location, will have a different duty which could affect its integrity i.e. stress, temperature, geometry, material defects, corrosion, etc.
3. Provision of detailed procedures which must be followed when dismantling a tank.
4. Provision of detailed procedures which must be followed to ensure the dismantled sections of the tank are correctly stored and transported so as to retain their original shape and minimise the risk of distortion.
5. Provisions of adequate guidance and procedures to ensure that when reconstructing a tank in its new location, the following aspects are correctly addressed:
 - a. preparation of base
 - b. preparation and inspection of dismantled plates
 - c. testing of welds
 - d. construction inspections
 - e. completion of hydrostatic test

4070 02 January 1988

Source : LOSS PREVENTION BULLETIN, 099, 21 AND 106; HAZARDOUS CARGO BULLETIN, 1989, JUN; THE GUARDIAN, 1988, 5 JAN.; PIPELINE & GAS JOURNAL, 1988, JUL.

Location : Monongahela River; Pittsburgh; Pennsylvania, USA

Injured : 0 **Dead** : 0

Abstract

A 48 year old, 48 foot high, 120 foot diameter cone roof tank undergoing its initial fill following relocation to a river terminal failed catastrophically, spilling 92,400 barrels of diesel fuel. The liquid overflowed the tank bund wall and much of it entered the river. The cause of the failure is unknown, but it may have been caused by defects in welding, in the structure, or in the material. It was also speculated that welding heat from disassembling and then reassembling the tank could have made the old steel plate more brittle. Subfreezing temperatures at the time contributed to the brittle condition of the metal. The reassembled tank had been partially x-rayed and hydrostatically tested with five feet of water. There was no fire, but cleanup costs were substantial.

[embrittlement, weather effects, tank failure]

Lessons

[None Reported]

Source : LLOYDS WEEKLY CASUALTY REPORTS

Location : Kekcse, HUNGARY

Injured : 0 **Dead** : 0

Abstract

Transportation. Main oil pipeline carrying crude oil sprung a leak of 300 to 350 tonnes of oil. The crack occurred overnight.

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]

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 corroded pipeline in the degassing service ruptured after the admission of liquid vinyl chloride. The water spray system went into operation. The source of the release was identified 45 minutes after leakage detection, the leaking pipeline occurred soon after that isolated. The gas cloud was practically dispersed 1.5 hours after the pipeline was isolated (almost no wind).

[gas / vapour release, corrosion, processing]

Lessons

1. Improved training for operators.
 2. Improved inspection procedures.
 3. Pipes in a gas service and in a degassing system to be equipped with liquid traps and to be installed in such a way so as to make visible inspection possible.
 4. The number of gas detectors to be increased.
 5. The plant drawings to be reviewed to determine the consequences of any maloperation, ensure rapid detection and check the efficiency of emergency procedures. Simple and efficient emergency response procedures are developed for all operations.
-

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

Location : , USA

Injured : 0 Dead : 0

Abstract

A river transport incident. A river barge used on ammonium hydroxide duty was overpressured while being loaded resulting in severe buckling of main deck. Cause was the corrosion of the pv valve which contained bronze components resulting in seizure of the valve.
[loading, valve failure, overpressurisation]

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 start-up procedure after maintenance of the compressors at the feeding section of a polyethylene plant, the pressure primary compressor discharge reached a value of 310 bar, although the operator switched the compressor off manually in response to a high-pressure alarm signal activated at 265 bar. The safety valve at the compressor discharge started to open at 279 bar, but reached full capacity too slowly. The high-pressure switch, which was supposed to cut off the primary compressor at 279 bar, failed. Due to pressure build-up a bursting disc, located also at the compressor discharge, burst at a somewhat lower pressure than expected (possibly due to fatigue). The bursting disc discharge piping had not been designed for the resulting dynamic pressure and was torn from the collector release line. Releasing gas ignited, resulting in an explosion and a flash fire.

[leak, fire - consequence, instrumentation failure, damage to equipment]

Lessons

1. Redimensioning of the pressure safety valve and discharge lines of the safety devices; - improved testing of the performance of the high-pressure switch.
 2. Practical tests of a new design with nitrogen.
-

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 : 2 **Dead :** 0

Abstract

The crude material, that 6 months earlier had been oxidised with nitric acid and then stored, caused an explosion during distillation in a 1250 litre capacity stainless steel device. The explosion was caused by the violent runaway decomposition of o-nitro-benzyl-nitrate, that had formed during oxidation, resulting in deflagration. Prior to distillation the temperature of the exothermic reaction had been obtained using a differential scanning calorimetry method and there seemed to be no problem. However, the crude sample had been washed with water, toluene and caustic soda prior to being tested, and the test equipment differed from that specified so that condensation of water within the equipment masked the identification of the exothermic reaction. The distillation device was equipped with a high temperature alarm (set at 140 degrees C), a high temperature trip of the steam supply (set at 150 degrees C) and a second trip (set at 170 degrees C) activating the dumping of the heavy hydrocarbon, all this could not prevent the explosion (the exothermic reaction started at 140 degrees C). It is thought that the automatic dumping system did not operate.

Substance involved: ortho-nitrobenzaldehyde.

[instrumentation failure, design or procedure error, damage to equipment, o-nitrobenzaldehyde]

Lessons

1. No further processing of this substance.
 2. A review of management system and control of processes is taking place.
-

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

Rupture of a 24 inch pipe resulted in the release and ignition of hydrogen in synthesis gas. This rupture caused further damage of adjacent piping and a minor ammonia release. The rupture was caused by fatigue induced by thermal cycling. Site emergency procedures were activated. The supply of natural gas to the plant was cut off and the plant shut down. There was no real need for external emergency services.

Minor leaks in this section had been detected before the accident and had been provisionally corrected without setting up a thorough investigation, which could have resulted in the early detection of the danger of fatigue corrosion due to thermal cycling.

[processing]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A road tanker was being loaded with class 170 bitumen (equivalent to 100 Pen grade) via the rear hatch with the front hatch open.

After about 3500 litres of product had been loaded (about 8 minutes) an internal explosion occurred inside the tanker. There was no significant fire after the explosion (perhaps due to oxygen starvation) and damage was limited to the tanker barrel, loss of product and superficial loading arm damage. Fortunately there were no injuries (the operator had only just left the loading gantry after confirming bitumen flow and the driver was in the office doing paperwork).

The source of flammable vapour within the tanker is thought to have been a combination of:

1. Off specification heat transfer oil (flash point ca 60 degrees C) contamination of the product due to tube failure in loading line preheater.
2. Bitumen overheating in the preheater to about 275 degrees C (cf normal 180 degrees C).
3. Possible residual traces of kerosene used by the driver to flush the pump and free the dipstick after the previous delivery

The two most likely sources of ignition were:

1. The heat transfer oil was off specification with a flash point of about 60 degrees C, much lower than the specified minimum of 219 degrees (presumably due to thermal cracking). The autoignition temperature of the oil degradation products of overheated (possibly degraded) bitumen mixture may have been exceeded.
2. Pyrophoric deposits inside tanker.

[loading, product loss, damage to equipment]

Lessons

The recommendations included:

1. Standing requirements in respect to Project Safety Reviews and Hazops to be enforced.
2. Reassess: (a) the design of temperature control mechanism of the heat exchanger to make it fail safe from overheating (b) the design of the heat exchanger operation warning light, to improve its function. (The warning light indicates heat transfer oil feed to the exchanger; it was not noticed during the incident). (c) Assess overall condition of internal tubes of heat exchanger and undertake all necessary repairs and/or tube replacements prior to recommissioning.
3. Re-assess level of training required for plant operators and establish and undertake training programmes, as necessary, especially in relation to bitumen plants' operation.
4. Establish and implement a cyclic inspection programme for the heat exchanger in accordance with recommend refinery and engineering practice and relevant codes.